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ROTUNDA

volume 37:number 2
2004/2005 winter

THE MAGAZINE OF THE ROYAL ONTARIO MUSEUM

China Blues

A look at the colour that has saturated traditional Chinese fabric—and society—for centuries.

WINTER 2004 / 2005

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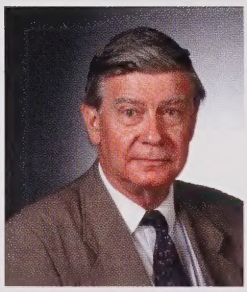


Dr. Nicholas B. Millet
ROM World Culture

THE LATE NICK MILLET'S ("An Old Mortality") fields of specialization were ancient Egyptian archaeology, history, and language, and Meroitic language and history. Nick came to the ROM in 1970. He was director of the Gebel Adda project of the American Research Centre in Egypt 1962–1966, and was cross-appointed at the University of Toronto.

Roberta Lawrie Shaw
ROM World Culture

AS AN ASSISTANT CURATOR at the ROM, Roberta ("An Ancient Mortality—Tribute to One of Our Finest") is conducting fieldwork and has developed exhibits in Egypt. In 2000, she was assistant curator for the ROM's blockbuster show *Eternal Egypt: Masterworks of Art in The British Museum* and recently served as resource person for a ROM tour of Egypt.

Gayle Gibson
Education Department

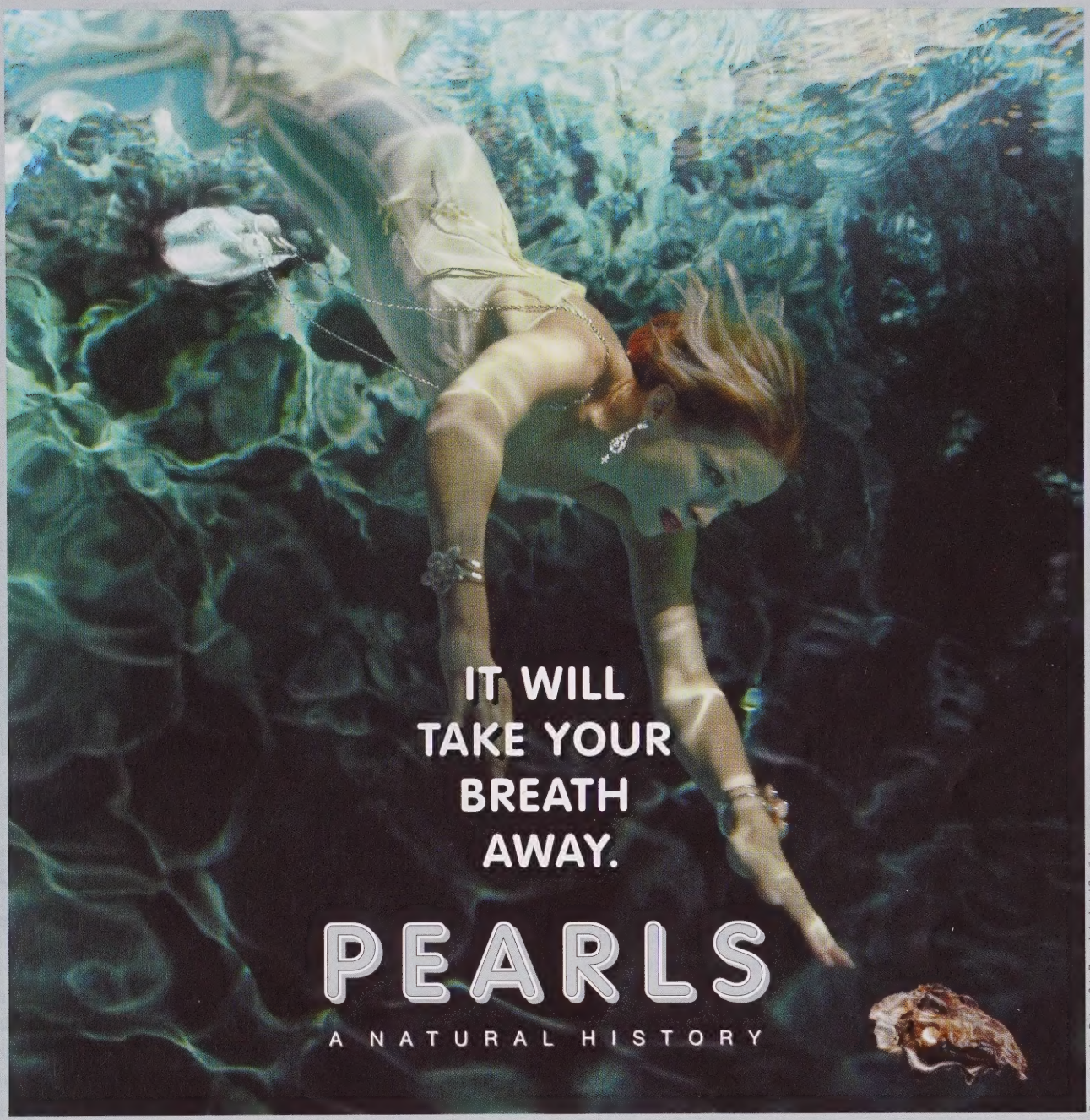
GAYLE ("An Ancient Mortality—The Lady of Thebes: An Afterword") has been a teacher in the ROM's Education Department since 1990. It was her pleasure to be a student of Dr. Millet's. She is currently the president of the Society for the Study of Egyptian Antiquities.

Dr. Glenn Wiggins
ROM Natural History

GLENN ("Caddisflies: Glimpses into Evolutionary History") retired in 1992 after 40 years as a ROM curator. Through his fieldwork and studies on caddisflies, the ROM became recognized as a leading centre for research on aquatic insects. He was awarded the 1992 Gold Medal of the Entomological Society of Canada for outstanding achievement, and continues to write about his Museum work.

Dr. Ka Bo Tsang
ROM World Culture

KA BO ("China Blues") is an art historian specializing in Chinese pictorial arts and calligraphy. She has also developed a strong research interest in Chinese culture, textiles, and symbolism. In 2002 she curated the exhibition *More than Keeping Cool: Chinese Fans and Fan Paintings*, for which she also authored a catalogue with the same title.



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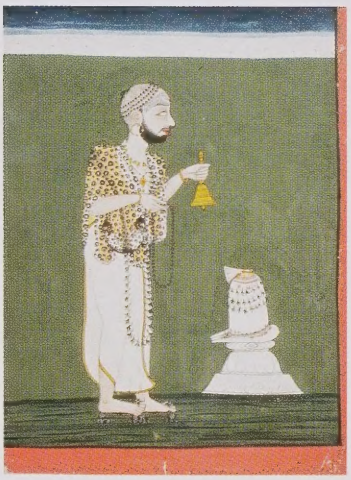

975.50.2 / BRIAN BOYLE, ROM

Fashionable Portraiture

An Eccentric Look for Rajas

THE RULING HOUSE of Mandi was descended from a branch of the Sen rajas of Bengal who established themselves in the Punjab Hills in the late 10th century. In this 18th-century painting acquired by the ROM in 1975, Raja Shamsher Sen is depicted as a devotee of the Hindu god Siva. Shamsher Sen succeeded his legendary seven-foot- (2.1-metre-) tall grandfather, Sidh Sen, when he was five years old; he ruled from 1727 to 1781. Tradition and, indeed, some pictorial evidence suggest that Shamsher Sen was a man of weak character and intellect with unconventional friends and interests. Nevertheless, he was also frequently portrayed in warrior's garb or, as here, as a profoundly religious man. The leopard skin around Shamsher Sen's shoulders seems to have been a favourite accessory and is featured in many pictures of him.

As is the case elsewhere in Hindu India, the fashion for portraiture in Mandi can be traced to Mughal influence. The style of early portraits of Mandi rulers dating from the mid-17th century is typical of Mughal court paintings of a slightly earlier period. Gradually, however, Mandi artists adapted and conventionalized some Mughal features to create their own strong artistic tradition. The result is that almost all portraits of Sidh Sen and Shamsher Sen contain a number of diagnostic elements. These include a flat, uniform background colour (frequently grey-green), a high horizon composed of bands of blue and white, the depiction of birds in the sky bands, and a preference for strong primary colours and carefully rendered decorative details. An eccentric style for two eccentric Rajas.

—Anne Marie Doyle

2004.41.2

Scre

A Distinctly Japanes

PAINTED BY a 17th-century anonymous artist, a Japanese six-fold screen entitled "Teika's poems on the Minase Villa" is one of three such screens recently acquired by the ROM. Screens, or byōbu (literally "wind fence"), were used primarily as portable partitions or enclosures within the typically sparsely furnished and highly flexible Japanese traditional residences. From medieval times, however, they were also developed as one of the major formats of Japanese painting along with hanging scrolls. In the 14th century, an innovative method of joining screen panels was invented in which paper hinges were concealed at the back. This resulted in a seamless, continuous surface, which could be decorated with painted scenes and /or calligraphy.

The ROM's screen, with its poems and painting, reflects the unique Japanese approach to the pictorial interpretation of literary works seen in every aspect of Japanese art. Here, three *waka* poems (Japanese 31-syllable poems), written by the prominent poet Fujiwara no Teika (1162–1241) in the early Kamakura period (1192–1333) are beautifully

TIONS

Idyll

ch to Depicting Poetry

inscribed by an anonymous calligrapher. The poems describe the poet's memory of his visit to the emperor's newly built villa at Minase in what today is Osaka prefecture. The first poem (on the second panel to the right), for instance, reads:

Memories of the villa mingle with the smoke rising from salt-making ovens,

Making it hard for me to return to the capital shrouded in evening mists.

The painted scene against a gold-leaf background—gentle green hills and summer flowers, such as golden-yellow *yamabuki* (Japanese globe-flower), white azaleas, orange lilies, and blue hydrangeas, near the pond—alludes to the poems. The subtle, dreamlike landscape, accentuated with the once silver-coloured moon and its reflection in the water (though both are now blackened), echoes the mood of the poems. While many other screen paintings based on Teika's poems depict poetic themes in a more explicit manner, the allusive interpretation of the spirit of the poems in this screen produces a highly evocative atmosphere.

—Akiko Takesue

ROM 55352 / FRANK BOXLER

Pterrifying Pterosaur

Rhamphorhynchus Died Choking on Dinner

FLYING REPTILES, or pterosaurs, dominated Mesozoic skies on Earth for more than 150 million years, from the late Triassic (220 million years ago) to the late Cretaceous (65 million years ago). Pterosaur bones, like those of birds, are very light and fragile, and so are preserved only rarely, and then in extraordinary settings such as the quiet Solenhofen lagoon in Bavaria, Germany. Even here, complete well-preserved skeletons of pterosaurs with a one-metre wingspan, such as *Rhamphorhynchus*, are found only once or twice in a generation. One was sold to the Edinburgh Museum 10 years ago. Last February, the ROM acquired a *Rhamphorhynchus muensteri* skeleton with the aid of the Louise Hawley Stone Charitable Trust. It is one of the best and most complete ever found. We can see this because the vendor, Raimund Albersdorfer, prepared the skeleton by rejoining the two sides produced when the limestone layer was split in the quarry. He then removed the rock from one side, exposing the complete skeleton in three dimensions. Along with the still-articulated skeleton, the wing membranes and the rudder at the end of the long tail are also preserved.

What is most remarkable is that the skeleton of a small fish, *Anaethalium knorri*, is embedded in the pterosaur skeleton where the gullet would have been. It is evident that the pterosaur flew down, caught and swallowed the fish, choked on it, and then fell into the lagoon and drowned.

So a minor tragedy from 150 million years ago will form the centrepiece of a fine flying-reptile display in the new gallery, The Age of Dinosaurs, to open in December 2005.

—Des Collins

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THE ROM GRATEFULLY ACKNOWLEDGES THE LOUISE HAWLEY STONE CHARITABLE TRUST FOR ITS GENEROUS SUPPORT OF THIS PUBLICATION

LETTERS

A fascinating and gifted resident of Richmond Hill produced beautiful works in silver.

ROSS FOX, ROM

2003.88.1.1-1.3 / BRIAN BOYLE, ROM

Left: The Douglas Boyd Rose Bowl. **Right:** ROM's coffee service by Douglas Boyd.

Silver Celebration

MEMBERS OF OUR COMMITTEE were very interested to learn about the ROM's recent acquisition of a Douglas Boyd silver coffee service. The article entitled "Scandinavian Design" by Dr. Ross Fox, which appeared in the Spring 2004 issue, provided some fascinating insights into the acceptance and contemporary appreciation of his craft.

St. Mary's Anglican Church in Richmond Hill owns three beautiful pieces of Boyd's ecclesiastical work. Their elegance and simplicity of style certainly reflect those qualities of "Scandinavian Modern" as described in Dr. Fox's article.

It seems to me that Mr. Boyd was a bit of a local legend here in town. Many parishioners describe both the man and his craft in such positive ways. I understand that much of his work was done on commission, often incorporating a rose theme, to reflect the fact that Richmond Hill at that time was well known as "the rose capital of Canada." After all, hadn't roses from The Hill been flown to London, England, for inclusion in the wedding bouquet of Her Majesty Queen Elizabeth II? During his heyday, Mr. Boyd created a variety of items for fellow parishioners at St Mary's—coffee spoons, tie clips, punch bowls, and candlesticks.

Mr. Boyd was also an active member of the Richmond Hill Garden & Horticultural Society, serving as its president from 1947 to 1948. His wife, Evelyn, was also president from 1964 to 1965. In 1952, Mr. Boyd both created and presented *The Douglas Boyd Rose Bowl* to the society "for the highest aggregate points in Rose specimens." With all due humility, I am honoured to give this trophy pride of place in my living room as recognition for my gardening efforts last year. Surmounted by tiny silver roses on each corner, this exquisite trophy is a tribute to his remarkable talent.

Our committee has planned a Parish program for Sunday, February 20, 2005, to celebrate the life and work of Douglas Boyd. We hope that residents of Richmond Hill will agree to join St. Mary's in displaying their silver and in sharing reminiscences of the life of this fascinating and gifted resident of Richmond Hill.

YOURS TRULY,
NORMAN MCMULLEN, CHAIR,
THE ARCHIVES COMMITTEE
ST. MARY'S ANGLICAN CHURCH
RICHMOND HILL, ONTARIO

Out Cold

Because frogs cannot migrate to warmer climes to escape the Canadian winter, they must find other ways to avoid the season's punishing cold and frost.

ROM DEPARTMENT OF NATURAL HISTORY

MARY FERGUSON

Top: Wood frogs are able to overwinter in shallow soil because they can tolerate below-freezing temperatures. **Bottom**: Toads must dig deep to stay below the frost line in winter.

BIRDS MIGRATE, mammals grow thick pelts, and trees shed their leaves. Animals and plants in Canada prepare for the cold season in a variety of ways. How do frogs cope with winter?

Animals such as frogs, which do not produce body heat through metabolism, are often referred to as "cold-blooded." This term is somewhat misleading—after all, if the sun warms a frog, its blood will certainly also be warm. The proper term for these animals is ectothermic, meaning that body heat is obtained from external sources; mammals and birds, which produce heat through internal metabolic processes, are endothermic.

Although the body temperatures of ectothermic animals vary according to the temperature of their surroundings, they are able to maintain their body temperature within a suitable range by seeking out sources of heat when they are cold and moving to cooler locations when they get too hot. They bask in the sun, seek out shade, or enter water.

This process works well as long as a source of heat is available. During a Canadian winter, though, heat is a scarce commodity. Remaining active during cold weather is impossible for an animal that depends on external sources of heat. Since frogs cannot migrate to warmer climes to escape winter, they must find other ways to avoid winter's detrimental effects.

Most aquatic frogs, such as bullfrogs and leopard frogs, spend the winter at the bottom of a body of water. They obtain oxygen from the water through their skin. Because of the cold temperature, their metabolic rate is very slow, and very little oxygen is required. Successful hibernation requires that the pond not freeze completely to the bottom during the winter. If ice contacts the frogs at the bottom of the pond, they will freeze; also, some liquid water is necessary as a source of oxygen. If the oxygen in the water is depleted during winter, the frogs may die.

ROSS MACCULLOCH

Other species, such as toads, do not overwinter in water. Instead, they burrow into the soil. They begin the winter near the surface, but as the frost penetrates deeper into the soil, they dig deeper, often descending more than a metre. Despite their very low body temperature and reduced metabolism, toads are able to dig if necessary to stay below the frost line.

Some species, such as wood frogs, which also overwinter in the soil, are able to survive at temperatures a few degrees below freezing. These species are called freeze-tolerant amphibians. When the temperature drops below freezing, some, but not all, of the water in the frog's body freezes. Circulation and respiration stop; ice crystals form in the abdomen, beneath the skin, and between the muscles. This process would result in death for most animals, but freeze-tolerant species produce high levels of glucose, which act as an antifreeze, preventing ice from forming inside cells and blood vessels. Glucose also prevents dehydration, which is another danger at below-freezing temperatures.

Experiments have shown that frogs do not produce glucose in anticipation of low temperatures. Rather, glucose production is triggered by the formation of ice at the frog's skin. As the winter retreats, the glucose is excreted and circulation returns.

As the temperature climbs in spring, the frogs begin to emerge from hibernation. Freeze-tolerant species usually overwinter close to the surface of the soil and are thus the first amphibians to react as the soil temperature increases.

Deep burrowers such as toads begin to move upwards later, as the warmer temperatures reach deeper into the soil. Frogs that hibernate on the bottoms of ponds are the last to emerge in spring, since water warms more slowly than soil.

Frogs make the most of the relatively short active season. Once they emerge from hibernation, all efforts are concentrated on mating. Freeze-tolerant species, such as the wood frog or spring peeper, are the first to breed, often moving to breeding ponds before the ice has completely melted. They retain some freeze-tolerance during the breeding period, because they often experience a cold snap during early spring breeding. They usually have a very short tadpole stage, which allows them to breed in temporary ponds—ponds that dry up in late summer and contain few predators. Species such as green frogs and bullfrogs, which emerge later, do not breed until summer. They must utilize permanent bodies of water, and tadpoles of these species do not become adults until the following summer.

Once breeding season is over, frogs concentrate on feeding. Energy reserves are accumulated in the form of glycogen or fat for use during the coming winter, which as every Canadian knows, is never far away.

Ross MacCulloch is assistant curator in the ROM's Department of Natural History.

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A Shining Example

Teamwork, generous donations, and high-tech know-how enabled the ROM to produce one of the best silver vaults in Canada.

Left: The ROM's new silver vault. **Top right:** Curator Peter Kaellgren with Marian Robertson. **Bottom right:** Front view of the vault.

SUSAN STOCK

AT THE 1999 OPENING of the exhibit *Silver: The Sterling Choice, Silver from the Norman and Marian Robertson Collection*, a benefactor of the ROM and friend of Mrs. Robertson asked me what would happen to all the beautifully polished silver in the exhibition once it was over.

I replied that it would return to storage and tarnish until the next time it was selected to go on display.

"What would it take so that this wouldn't happen?" he queried. "Is there something we could do?" I knew the answer—if we had the funding.

On a professional excursion to the National Gallery of Ottawa in 1995, Marianne Webb, the ROM's Decorative Arts conservator, and I visited colleague Doris Couture-Rigert, conservator of Sculpture and Decorative Arts. Many years earlier, during the National Gallery's construction, Doris had visited Toronto to canvass her ROM colleagues, given our experience, about what tools and equipment we would recommend or put on our wish list. This was our return visit to see what had evolved. The National Gallery's Conservation Labs are out of this world—practical and beautiful.

Even more intriguing was a facility she showed me, as I complained about

CAROL BAUM

all the silver I had to clean. Her new silver vault had a controlled relative humidity (RH) of 35 percent, special museum-quality cabinets, filtered air, Pacific Silver cloth on every shelf, *and* she had not had to polish the gleaming silver stored there for the previous 10 years. I took pictures and began my mission to "get me one."

Years later, to my delight, the conversation I had with our benefactor has resulted in an even more beautiful facility than the one in Ottawa. Dan Rahimi, head of Collections Management, and Alana Silverman, ROM Foundation, swung into action to support the initiative.

Our powder-coated steel cabinets have glass fronts, which leave visible both shelving units and drawers. This minimizes the amount of handling required to view objects while providing a perfect display venue for teaching or developing displays. The silver does not need to leave the climate-controlled space while being used.

The relative humidity is approximately 19 percent. The drier RH helps reduce the rate of tarnish. For silverware with organic material (wood or ivory) attached to it there is a separate display unit, which will be conditioned to a higher RH of 40 to 45 percent using silica gel. The air is filtered by a circulating fan, which has two filter materials in it that absorb hydrogen sulphide, carbonyl sulphides, organic acids, and other gases that may cause corrosion.

Interior finishes were limited and carefully chosen to reduce the risk of their off-gassing corrosive vapour. The walls were painted several months in advance so that they could dry and off-gas fully. Gasket materials are conservation-approved and were Oddy-tested by conservator Helen Coxon to confirm that they were inert. Because the rails holding the cabinet carriages for compact storage required a raised floor, we installed a metal floor, levelling it to rail height.

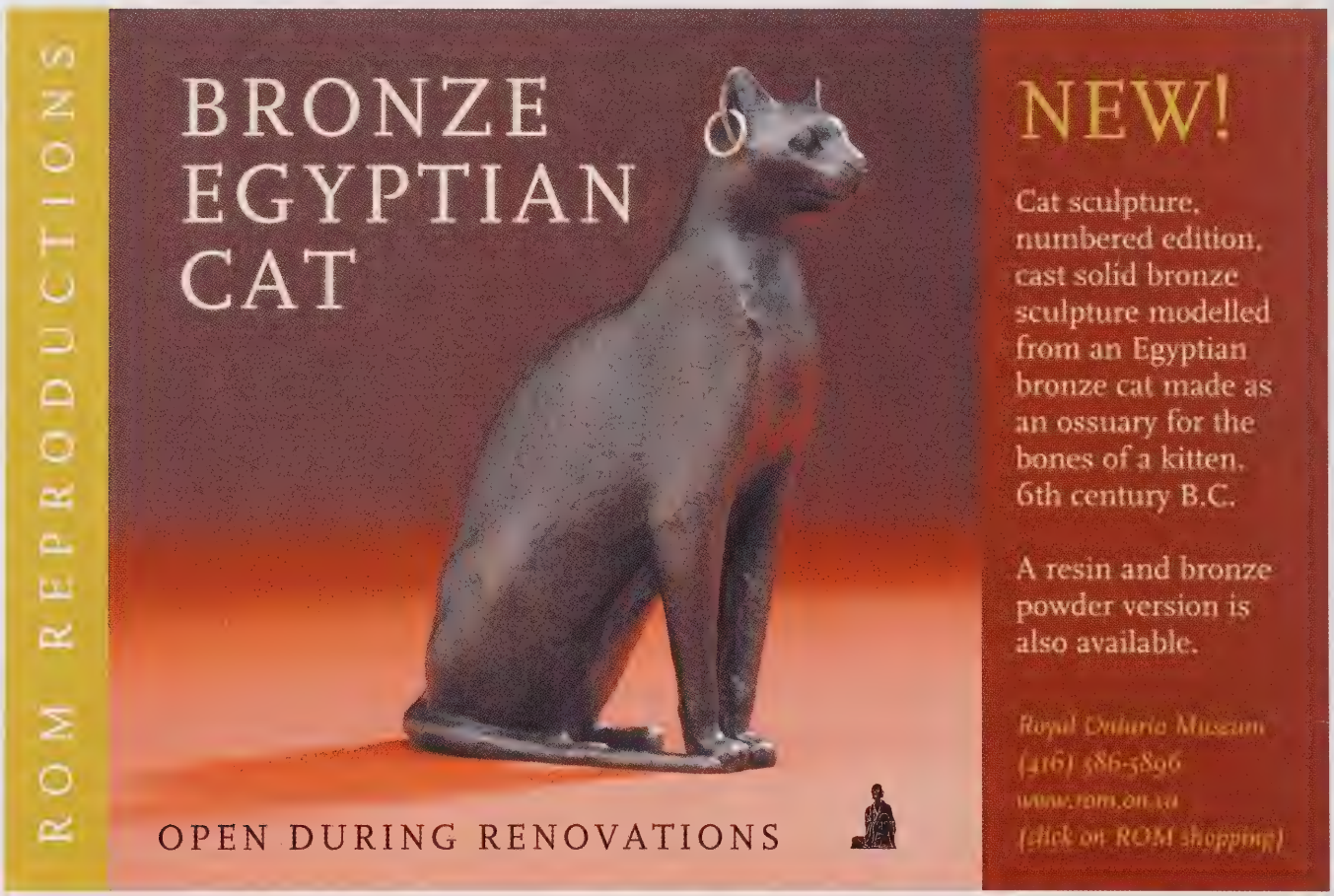
A student volunteer, Molly Minnick, carefully cut and hemmed the Pacific Silver cloth, which is placed on every shelf as added insurance against tarnish.

Organization of the space for curators Peter Kaellgren (European silver) and Ross Fox (Canadian silver) by collection managers Carol Baum and Catherine Wyss has taken hours of care—and we have only started. Lory Drusian, project manager, finally brought the entire facility to completion.

The project is a huge success and hopefully one that will set a standard for collection care at the ROM, as William Thorsell said at the opening of the Norman and Marion Robertson Silver Vault on August 10, 2004. The staff extends much appreciation to our benefactors and donors who have made this dream a reality.

In the end, I am confident that our silver collection will remain bright—so that I never have to polish it again.

Susan Stock, the ROM's archaeological metals conservator, trained at the Institute of Archaeology, London, and enjoys sharing her years of experience.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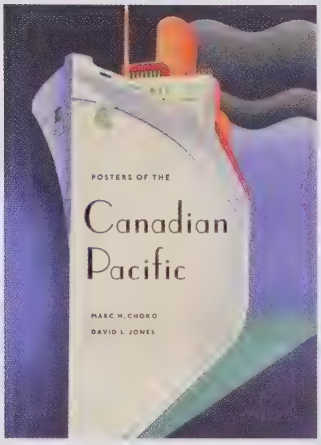
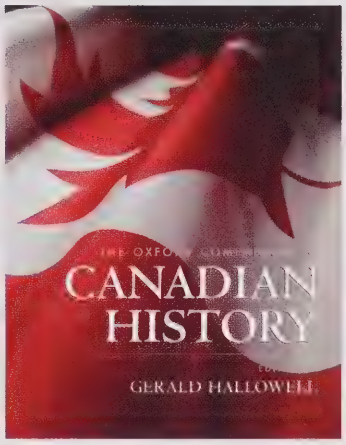
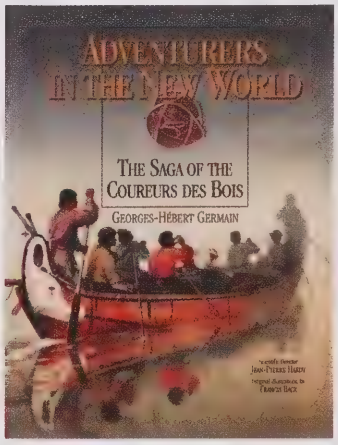
Pemmican to Pinot Noir







Posters of the Canadian Pacific

Marc H. Choko, David L. Jones
(Firefly, Cloth: $49.95)

SUMPTUOUS, LAVISH, and beautifully produced, this exquisite volume exhibits nearly a century of poster art emanating from Canadian Pacific enterprise.

The Oxford Companion to Canadian History

Gerald Hallowell, ed.
(Oxford, Cloth: $79.95)

A RICH SOURCE of essential information about Canadian history, this important work draws from the expertise of more than 500 contributors, including the ROM's Nora E. Vaughan Fashion Costume Curator, Dr. Alexandra Palmer. It is also a font of historical trivia, some of it ironic. Prime Minister Lester B. Pearson, after whom Toronto's international airport is named, was a student in Britain's Royal Flying Corps in WWI—until he crashed his plane and returned to Canada. Some entries challenge expectation: rural depopulation in Canada began as early as the 1870s. Other entries shed light on Canadian historic sites: when Norse peoples made landfall at l'Anse aux Meadows around A.D. 1000 and met eastward-migrated Skraelings, they completed humanity's encirclement of the globe, begun some 99,000 years and 4000 generations earlier out of Africa.

From Grand Pré to *Georgia Straight*, from *filles du roi* to Japanese picture brides, the *Companion* is an authoritative and entertaining guide to the Canadian experience.

The Museum Called Canada: 25 Rooms of Wonder

Charlotte Gray, Sara Angel
(Random House/Otherwise Editions, Cloth: $65)

AN ARTIFACTUAL HISTORY of the country, *The Museum Called Canada* is a testament to the power of objects to evoke and inform. Royal Ontario Museum artifacts showcased include Benjamin West's epic, heroic, romantic *Death of Wolfe*, the original of which was copied five times by West for wealthy patrons, including King George III. Another war-associated ROM artifact featured is a pocket compass reputedly given by Sir Isaac Brock to the Shawnee chief Tecumseh before their August 1812 attack on Fort Detroit. The book also includes a photograph (*en face* from the author's introduction) of the ROM's spectacular new Canada Court. Canadian symbols exhibited range from beaver and maple leaf artifacts to relic-icons such as Tom Thomson's paint-splotched palette and a Maurice Richard jersey. A material tour of Canada's history and prehistory.

Adventurers in the New World: The Saga of the Coureurs des Bois

Georges-Hébert Germain, Jean-Pierre Hardy
(Canadian Museum of Civilization, Cloth: $39.95)

FROM THE SEIGNEURIES of the St. Lawrence Valley to the distant reaches of the continent, this new study tracks the *coureurs* as the fur trade, fuelled by fashion, brandy, and pemmican, pushed westward. It is as if we are there with them, traversing the *pays d'en haut* in all of its alluring possibilities. Meticulously researched, liberally illustrated with image and artifact. An engaging work.

SELECTED AND REVIEWED BY GLEN ELLIS

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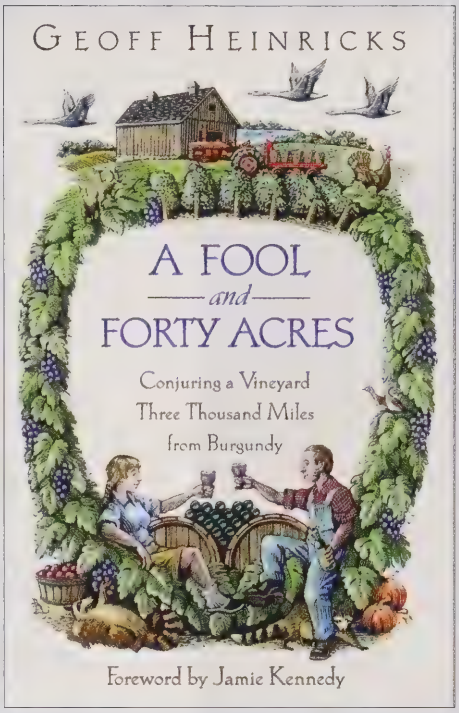
A Fool and Forty Acres: Conjuring a Vineyard Three Thousand Miles from Burgundy

Geoff Heinricks, Foreword by Jamie Kennedy (McClelland & Stewart, Cloth: $34.99)

PART PASTORAL IDYLL, part viticultural primer, this reflective journey through (somewhat surprisingly) the vineyards of eastern Ontario's Prince Edward County is a delight. Clearly, Heinricks is inspired in his quest to cultivate superb Pinot Noir on what Burgundians would perhaps imagine to be a few acres of snow between Lake Ontario and the Bay of Quinte. He writes of "the pure hedonistic, almost spiritual delights that great–truly great–wines achieve." Here, here. Note that in the gastronome's universe, hedonism, when it is *really* good, approaches the spiritual. And as with any wine connoisseur worth his bouquet, a phantasmagoria of images may be elicited by a single sip of vintage, everything from "ripe strawberries" and "a note of rich buttery pear" to "cinnamon and clove starting to overtake a shadow of dark cocoa." And elsewhere, a "mix of flavours and aromas taking repeated little curtain calls, with delightful glimmers of butterscotch footlights shining through it all."



Heinricks is a keen observer of his adopted *terroir*. His commentary ranges from carp in the waters below Consecon bridge to carping about heritage architecture obscured beneath vinyl and aluminum siding. In this, he is a spiritual successor to Thoreau. He was formerly a sojourner in Toronto. And when he was, he writes, he and his wife determined the "real" first day of winter and of spring by the ROM's covering and uncovering of its guardian stone lions *(shi shi)*, now flanking the Museum's Queen's Park entrance. (My colleague who decides these things will be astounded.)

Well written, well edited, tastefully designed and produced, *A Fool and Forty Acres* chronicles a noble and heroic effort. The world awaits Domaine La Reine, the *Quintessential* Pinot Noir.

The Engines of Our Ingenuity: An Engineer Looks at Technology and Culture

John Lienhard (Oxford, Paper: $19.95)

THE LINKS BETWEEN technology and culture are sometimes unexpected. The medieval Church, for example, was a centre of technology—"Cistercian monasteries were virtual factories, whose water wheels cut wood, forged iron, and crushed olives." The distinction between a cultural and a technological icon is often very fine—one of the seven wonders of the ancient world, the Pharos at Alexandria suspended a colossal bonfire 400 feet above sea level. The iconic cathedrals of the Middle Ages, technology approaching the miraculous, "levitated tons of stone" as homage to heaven. A technology of commerce, coins from classical antiquity document a pantheon of gods and goddesses.

By the beginning of the 20th century, the interchangeability of parts had advanced mass production to the point that an incredulous audience was treated to theatrical proof—in 1908, three newly minted Cadillacs were publicly disassembled, each into its 700 component pieces. The parts were then shuffled and three new composite cars, a patchwork of paint colours, reassembled, and the cars driven away.

The evolution of a technology may span several centuries. The Mount Palomar Observatory, for nearly 40 years (1948–86) the world's largest, was the direct descendant of Galileo's "optik tube." To create its mirror, a 50-foot "lake" of molten glass was boiled at 2700° Fahrenheit. It took more than eight months to cool.

A highly readable, informative account. The human dimension of technology.

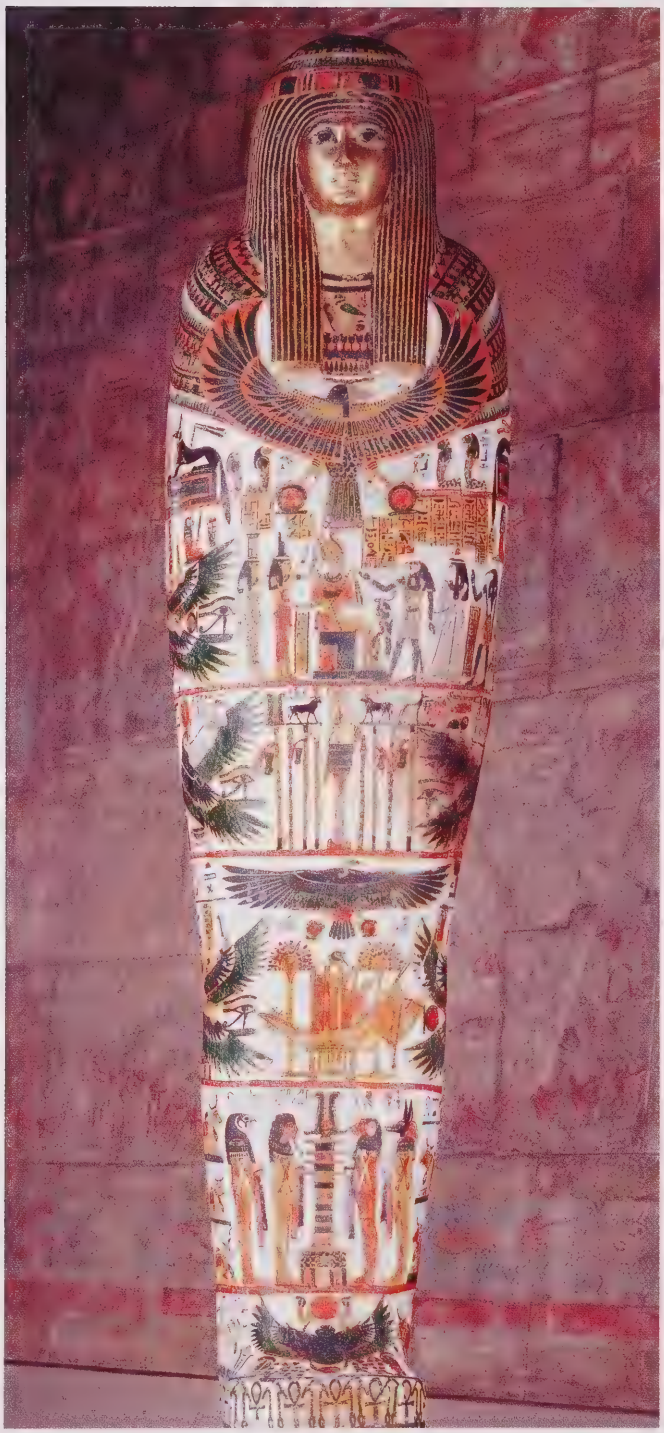
The House Book

(Phaidon, Paper: $14.95)

THIS PANORAMIC OVERVIEW of habitations ranges from cliff dwellings to palaces, from hide, bark, and snow houses to intricate contemporary architecture utilizing newly developed structural and cladding materials. Five hundred houses are included, alphabetically arranged by architect, patron, designer, or, where applicable, by tribe. Each structure is illuminated by expert commentary and superb photography. An attractive at-a-glance guide to the global diversity of shelter.

Glen Ellis is head of Publications, Royal Ontario Museum.

AN ANCIENT



910.10 / BRIAN BOYLE, ROM

For decades, Egyptologists deplored the image of Egypt as a land of tombs, despite its popularity with the public. N. B. Millet, curator of Egyptology, was far ahead of his time in recognizing the rich information that lay dormant in mummy-cases and their decoration. Herewith, a prescient article he wrote in 1972.

MORTALITY

By N. B. Millet

BRIAN BOYLE, ROM

Opposite: The cartonnage of Djed.maat.es.ankh. The face is gilded, as are some of the details of the painted representations. **Above top:** A picture of the deceased, in the fashionable lady's costume of the time, is prominent in this vignette of the judgment of the soul. Two gods attend the great scales, while another, the ibis-headed Thoth, god of writing and registrar of the gods, leads Djed.maat.es.ankh into the presence of Osiris. **Above bottom:** Protective deities on the shoulder of the cartonnage.

ALTHOUGH EGYPTIAN MUMMIES and their containers are highly popular exhibits in any museum, they remain, among all the wealth of material from ancient Egypt, the least known and least studied by Egyptologists themselves. This is in a way understandable. Egyptologists as a class tend to deplore that image of Egypt as a land of tombs, which so attracts the public, and would like to emphasize other more important (and more cheerful) sides of the Egyptian and his culture. Almost nothing has been written on mummy-cases and their decoration, and many Egyptologists would be in fact unable to date a particular coffin more closely than by a few hundred years. Still, as historical and religious documents, such things have a very real value, and their colourful and (to the public) exciting appearance lends itself rather well to exhibition and educational purposes. As an example of what can be learned from a mummy-case in the way of information about, or illustration of, Egyptian culture, we can examine one particularly fine example in the ROM, that of a Theban lady of the 22nd Dynasty, about the middle of the 9th century BC.

The cartonnage coffin numbered 910.10, and thought to have been obtained by C. T. Currelly in Egypt, belonged to a lady named Djed.maat.es.ankh, whose name means "the goddess Maet has said that she will live." Personal names at this late period in Egyptian history are often revealing, and sometimes pathetically so. In this particular case, it would seem that before our lady was born her parents sought the assurance of a deity, the goddess of truth and justice, that their baby would survive. This would have been done in the case of some gods by means of a regular oracle, but we know of no oracle of Maet. No doubt Djed.maat.es.ankh's parents had recourse to a simpler means of household divination, or to a

BRIAN BOYLE, ROM

TRIBUTE TO ONE OF OUR FINEST

Working with Nick Millet, who died May 19, 2004, at age 69, was a privilege and he is sorely missed as our ultimate authority on matters Egyptian here at the ROM. His knowledge was encyclopedic, not only for Egypt but also for several other unrelated topics that piqued his curiosity. Whenever we were stumped on any puzzling issue, the immediate solution was, "Let's ask Nick." I remember obtaining a fantastic mask that he immediately identified as Rangda, one of many south Asian goddesses. He was a cognoscente on anything pertaining to Napoleon, military history, and heraldry, three of his extra-curricular interests. He was a master at artifact authentication and he kindly continued this task after his retirement in 2000. Nick was my teacher at the University of Toronto for several courses and he was truly amazing. A classmate of mine once advised a newcomer, "Listen to everything Dr. Millet says and write it all down, because he is full of brilliant insights into Egyptian art and iconography."

dream. Our lady's mother is also named in the inscriptions of the coffin; she was called Shed-taope, which means "the goddess Taope has saved her." Taope was the hippopotamus goddess who presided over childbirth and drove away evil influences from new-born children, and it would seem that Djed.maat.es.ankh's mother had herself barely escaped the fate of the many infant children who must have died at birth in those days.

Both Djed.maat.es.ankh and her mother are given the titles of "the lady of the house and musician of Amun." The god of Thebes, Amun or Amun-re king of the gods, was the greatest of the gods of Egypt at the time. He dwelt in the enormous temple complex of Karnak, at Luxor in Upper Egypt (known to the Greeks as Thebes) and controlled through his vast priesthood a substantial fraction of the land and wealth of the country. There can be very little doubt that Djed.maat.es.ankh was herself a Theban by birth and residence, and that she was buried somewhere in the sprawling complex of cemeteries and funerary temples, which lies on the west bank of the Nile, across the river from the temple where she served. Her husband's name is also given; he was a "doorkeeper of the house of Amun" called Pa.ankh.ntof. Since it is not usual for a husband's name to be added to a woman's coffin, we are no doubt justified as seeing Pa.ankh.ntof as having survived his wife and having paid the expenses of her burial.

The fact that both "musician of Amun-re king of the gods" and "door-keeper of the house of Amun" are priestly titles of a sort should not betray us into thinking that we are dealing with a purely priestly family. After all, the "musician" was only a member of the temple choir, and although we do not really know what a temple doorkeeper actually did (if he did anything), it is clear that he was very low in the scale of temple attendants. He probably simply served on festival occasions with a group of colleagues who guarded the temple gates against unauthorized persons and collected entrance-fees. Djed.maat.es.ankh herself probably was entitled to a small fee for playing music for the choir on such occasions. Both these positions were no doubt mildly lucrative and had to be purchased from the priestly authorities for a fee. Such buying and selling of offices, important and otherwise, was a part of social and economic life in Egypt at the time. Even rather lowly positions such as these enjoyed by this couple would have carried much social prestige and a certain desirable feeling of being

one of the god's household, and thus under his protection in this world and the next. Most of the priests and priestesses whose mummies and coffins crowd modern museums were not full-time servants of their gods, but simply prosperous middle-class citizens who held priestly offices as additional sources of income and prestige, while their real careers and livelihood lay elsewhere. Many of the men who proudly styled themselves priests of this or that god at this period were very likely officers in the army, which, in fact, controlled the country and far outweighed the priesthood in political power.

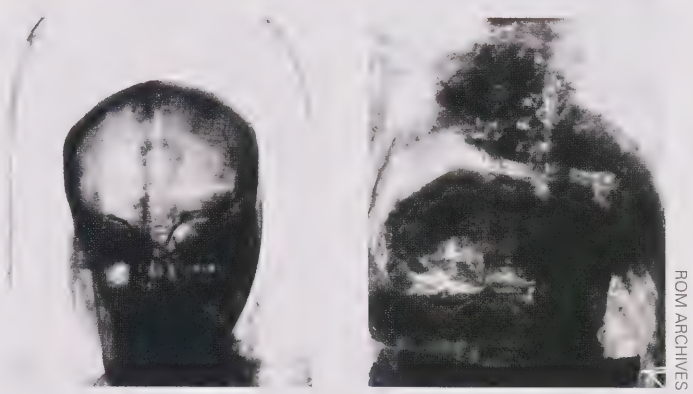
We are fortunate in having on our cartonnage a depiction of Djed.maat.es.ankh herself, as she would have looked in life. In the first register she is shown in festival attire being led into the presence of the great god of the afterlife, Osiris, "Foremost of the dwellers in the West." The picture is certainly not intended as a portrait, but rather as a generalized depiction of a lady of her station in life. She wears a long, pleated robe, made of a simple rectangular piece of very thin pinkish linen with a blue hem, draped and knotted rather than tailored, and a wide collar painted green. Her wig, a heavy affair hanging to well below the shoulders, has the rounded bottom contours characteristic of the fashions of the 22nd Dynasty. This imposing headdress is made more impressive still by a white fillet and a large blob of scented fat placed on top, an element of the festival dress of the day. Its purpose was to melt and run down over the head and body of the wearer to cool her off and provide a pleasant smell to counteract the rather strong odour of the barley-beer served at the festivities.

The cartonnage has never been opened, but it and the mummy within have been X-rayed, and we are able to say something about Djed.maat.es.ankh herself. The body appears to be that of a small woman, just slightly over five feet tall, and probably fairly young, somewhere between 25 and 40. On the X-ray plates it can be seen that she was embalmed in accordance with the accepted practices of the period, with packing materials introduced under the skin of the neck, shoulders, and rib cage, to fill out the contours to an approximation of life. This strange practice seems to have begun in 21st Dynasty times, some 200 years before our lady lived. At that time extensive tomb-robbery had begun in the Theban necropolis, and the tombs of the kings themselves, hidden in their secret valley, had not been immune. The pious officials and priests of Thebes did what they could to restore the damage, and had the royal mummies re-wrapped and

This alone would have made his classes pure pleasure, but his congenial and personable manner made them doubly so.

Everyone who encountered Nick admired his genteel manner. Always attired in his trademark three-piece suit, generally sporting one of his antique gold pocket watches complete with antique fobs, he looked every inch the old-fashioned curator. I remember he was always confused, and amused, about what exactly was the "new" colour taupe, until he went out and got a taupe waistcoat, just to clear that up. He inspected the Egyptian and Nubian galleries every day to check on the welfare of the objects, noting any physical-plant maintenance needs. This tall, dignified man might have seemed rather remote at first glance, but his friendly "Hi chum" to staff (and he especially liked the guards) soon dispelled that. He once told me that he saw many people as combinations of well-known characters, and that he saw himself as a combination of Sir W. M. F. Petrie—the "father of Egyptian archaeology"—and Howdy Doody! He never ever slipped into the trap of self-satisfaction or egoism and had a knack for spotting those who did. He loved being involved with projects that expanded and extended the Egyptological discipline and was thrilled to be a part of the autopsy in 1974 of Nakht—a mummy discovered at the Temple of Deir-el-Bahri at modern-day Luxor and brought to the ROM by C. T. Currelly (*Rotunda* Vol. 7, No. 4)—and the CAT scanning of Djed.maat.es.ankh, a mummified young woman from Thebes, in 1978 and 1994 (*Rotunda* Vol.28, No. 3). His article, originally published in *Rotunda*, Vol. 5, No. 2 (1972), and reproduced here, was an early contribution to the study of coffin imagery. Since then, the subject has exploded. He also loved cats.

—Roberta Shaw
Assistant curator, Egyptian, in the ROM's Department of World Culture.



ROM ARCHIVES

Left: Radiograph of the head of the mummy. The outline of the mask of the case itself is visible. The artificial eyes are just discernible, as is the packing around the throat. **Right:** Radiograph of the thorax. The vague whitish masses within the rib cage are the parcels containing the embalmed entrails.

BOTTOM LEFT: ROM ARCHIVES; OTHERS: BRIAN BOYLE, ROM

Top: The sacred boat of Sokar, the ancient hawk-god of the Memphite cemetery, appears in the third register or section of the cartonnage. **Bottom left:** View of the back of the cartonnage showing a painted representation of the Djed-column, an old Osiris cult-object, which also symbolizes eternal stability. The heavy stitching has been covered with a strip of linen containing a funerary prayer for the dead woman. **Middle right:** The sacred cows and the bull that symbolize eternal nourishment for the dead in the afterlife. **Bottom right:** The winged scarab of the sun protects the feet of the mummy. In some mummies of the period an amulet in this shape is found in the wrappings of the feet.

buried in secret a second time. Once, however, these upper-class Egyptians had seen with their own eyes the changes brought about by mummification, they may have pressed for the development of techniques that would make the finished mummy look more like the living body. Thus the embalmers of Djed.maat.es.ankh's time packed the body's cavities with mud, linen, sawdust, and other materials, and introduced packing under the skin of arms and legs at a point in the process when the skin was still soft. The X-ray shows also that artificial eyes have been inserted; of what material we do not know. Four masses inside the chest are certainly the packets containing the embalmed entrails, removed at an early stage in the process, and returned before the bandaging was to begin. These operations were performed through an opening in the left side, at about the waist. One of the Greek historians tells us that the technician who had to make this cut was ritually driven off by his colleagues, with stones and curses, since it was theoretically a wicked act to mutilate a human body, even when it was necessary for its preservation. A four-sided plate, of metal or bees-wax, visible in the X-ray plate, covers the incision, and is probably marked with the symbolic "eye of Horus" to compensate magically for the unavoidable wound. Over the chest of the body lie two of the amulets which ancient custom prescribed, a vulture with outspread wings, perhaps of sheet gold, and a large scarab, traditionally of dark green stone such as green jasper. These amulets are enclosed within the numerous layers of sheeting and bandages, which compose the mummy wrappings.

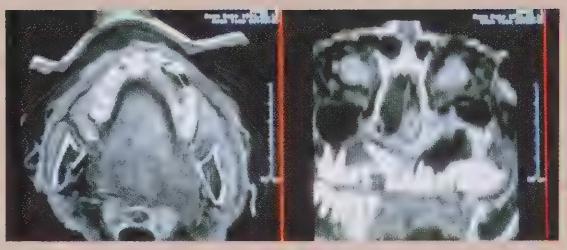
Once the embalming and wrapping were completed, to the accompaniment of the recitation of protective spells by an attendant priest, the mummy was transferred to the previously prepared cartonnage. In earlier times a closely shaped wooden coffin served as the immediate protection of the body, set inside one or more larger coffins, nested like a set of Chinese boxes. By 22nd Dynasty times the rising cost of cedar wood, no longer easily obtainable from the Lebanese hills, had resulted in the substitution of stiffened canvas. Many layers of cloth, saturated in a thin adhesive solution, were moulded on a mummy-shaped wooden form. When dry, the resulting carapace could be cut up the back, spread, and removed. Once the body was inserted, the cartonnage was laced tightly up the back like an old-fashioned corset and a wooden plank fitted in to close the foot-end. The cartonnage was then plastered to make it ready for the all-

important decoration.

The painter who carried out the decoration of Djed.maat.es.ankh's cartonnage was probably one of a fairly large group of craftsmen attached to the temple of Amun at Karnak, and available to private persons for a fee. He was, as his work shows, more of a competent and well-trained illustrator than a gifted or creative artist. There can be little doubt that, when commissioned to decorate a set-piece such as a coffin, he would have worked from some sort of model, but it is likely, I think, to have taken the form of a list of written descriptions of suitable scenes, vignettes, and elements, rather than of a pictorial pattern book. From such a list he or his patron, Djed.maat.es.ankh's husband, would have made a selection. The general arrangement and choice of subjects was, of course, largely determined by tradition and the fashions of the moment. One overriding consideration was the fact that the scenes should be arranged so as to be properly seen when the cartonnage was in a standing position, for a mummy made its last public appearance standing before the tomb-entrance during the final rites, and during the funerary banquet. This was an affair like an old-fashioned European wake, when the relatives and guests celebrated the unhappy event with food and drink consumed in a festal atmosphere.

Some elements, indeed, of the decoration of our cartonnage reflect directly the party atmosphere that surrounded the funeral ceremonies. Djed.maat.es.ankh is shown wearing on her head and around her shoulders elaborate floral decorations of a kind handed out at Egyptian parties as favours, and occasionally found preserved in tombs. These are headwreaths, garlands, and wide collars made of flower petals and leaves strung together or sewn on papyrus-paper foundations, worn during the celebration and discarded afterwards.

For the rest of his decoration the painter chose symbols and episodes from the two Egyptian myth-cycles that meant the most in the funerary cult, those of the sun-god Re and of Osiris, king of the dead. Thus the ram-headed hawk whose outspread wings cover and protect the dead woman's chest, the scarabs at the foot and on the crown of the head, and the naked child under the left shoulder, are all forms of the sun-god, who according to the most ancient notions ruled the underworld at night as he did the upper world in the day, and in whose heavenly boat the early kings of Egypt believed they would travel forever after death. For centuries, howev-



COURTESY THE HOSPITAL FOR SICK CHILDREN

THE LADY FROM THEBES: AN AFTERWORD

The Lady from Thebes continues to engage museum visitors, scientific investigators, and Egyptologists. In 1994, under the direction of Dr. Millet and Dr. Peter Lewin, a pediatrician at the Hospital for Sick Children and researcher in ancient disease, Djemma underwent a full-body CAT-scan while still in her lovely cartonnage (See "The Faces of Djed" in *Rotunda* Winter/1995). The information obtained was reconstructed into three-dimensional computer images by medical radiation technologist Stephanie Holowka and imaging specialist Mike Starr.

No one had expected the CAT-scan to reveal the cause of Djemma's death, but the results were very suggestive. Our old friend had suffered from a chronic dental abscess, which may have burst and poisoned her. The scan also revealed that Djemma and her husband, Pa.ankh.ntof, were probably childless. More than a few tears were shed for these old sorrows when Dr. Millet told the ROM's docents and teachers.

As one of Nick Millet's students in Egyptology, and later as a teacher at the ROM, I enjoyed many conversations with him about Djemma and her coffin. (Though the mummy's name is sometimes spelled Djed.maatius.ankh and most people call the lady "Djed," there is pretty good evidence that the "d" was not pronounced, and that her friends called her "Djemma." Dr. Millet did.)

I have always been interested in the decoration, which does not tell about Djemma's life, but about her afterlife. Many of the scenes refer to chapters from the *Book of the Dead* and substitute for placing an expensive copy of the book in the cartonnage. Other images function as amulets. Together they ensure her eternal safety and comfort. It has always puzzled me that the scenes contain several mistakes.

The most prominent "mistake" concerns the cows visible on the sides of the coffin, just above ankle level. In Chapter 148 of the *Book of the Dead*, the deceased prays to these celestial animals for sustenance in the next life. The cows are the Seven Hathors, each with her own name, and

BRIAN BOYLE, ROM

the bull, the Husband of the Cows. They are a common image on coffins from the 21st Dynasty, the period just before Djed.maat.es.ankh's, but hers is the only 22nd Dynasty coffin that I know of with all seven cows.

What are the mistakes? If you stand in front of the case, and count the cows, you'll see four on the right side (three cows and the bull) and three on the left. Unfortunately, six cows are no more magical than six dwarfs would be in the story of Snow White! The artists who were painting the coffin somehow miscounted, and another artist had to add the seventh cow. (She's higher up, on the left side, just under the Weighing of the Heart scene.)

The scribe had a problem with the names of the animals, too. Somehow he looked at the middle cow on the right side and wrote "bull, Husband of the Cows," then wrote the same title above the bull himself, a few lines down. (This mistake seems funnier in hieroglyphs, where the words for "bull" and "husband" required the scribe to draw five penises while looking at an obviously female animal.)

There are other odd things about the decoration. Why would the artists and scribes have had such difficulty? I have been looking at other 22nd Dynasty cartonnage coffins to find an answer. In Philadelphia, the coffin of Nebnetcheru (University of Pennsylvania Museum of Anthropology and Archaeology at Philadelphia, E.14344b,c.) was certainly decorated by the same team of artists, but has only two cows. Two other coffins are quite similar, but cowless: Amunnestawynakht (St. Louis Art Museum, 109:1989) in St. Louis and Paankhenamun (Art Institute of Chicago, 1910.238) in Chicago. Studying these coffins has led me to believe that Djed.maat.es.ankh's was among the earliest of a new style of coffin decoration (the earliest in the new style being Nakhtefmut in the Fitzwilliam, E.64.1896 at Cambridge). The style of the previous dynasty had been crowded—jammed!—with images of gods, genies, and scenes from the *Book of the Dead*. Under the Libyan rulers of the 22nd Dynasty, a much simpler decorative scheme had been developed in the North of Egypt. Some images formerly displayed horizontally on the sides of coffins were now shown vertically, on the front. Artists in Thebes had to decide which elements were really necessary for a successful voyage to the afterlife (I have considered this issue at some length in "The Case of the Misplaced Cow:

er, the old solar funerary myth was eclipsed by the more democratic and more human faith of Osiris, the kingly god who, after his treacherous murder on Earth, had passed on to be ruler of the world of the afterlife, and who received into his pleasant paradise all those who had lived without offending god or man. By the 15th century BC, however, the old solar concepts began to come into fashion again, and by Djed.maat.es.ankh's time were an accepted part of funerary belief. Thus the Egyptian of 850 BC had not one religion of the dead but two, and apparently had no difficulty in accepting both as accurate pictures of the life after death.

The subject matter of the Osiris myth dominates the decoration of our cartonnage, and three aspects of Osiris himself are commemorated in the central part of the first, second, and last of the four registers into which the painter divided his field. At the top is the scene that represents the final triumphant denouement of the immortal dead. Here Osiris, "foremost of the dwellers in the West," seated among his attendant gods and goddesses, receives Djed.maat.es.ankh as she emerges victorious from the assessment of her character by means of the great balance, in which her heart is weighed against a feather symbolizing righteousness and proper behaviour. In the second register stands the plumed symbol of Osiris in his form of "the Lord of Abydos," his chief and most ancient cult-town in Upper Egypt. At the bottom, flanked by the four "sons of Horus," is another pillar-shaped cult-object associated with Osiris as "lord" of his original home, the town of Busiris in the Delta.

The third register makes note of still another funerary cult, one particularly characteristic of the 22nd Dynasty. This is that of the hawk-god Sokar of the ancient Memphite cemetery area, across the river from where Cairo now stands. The worship of this ancient and puzzling deity was instituted in the Karnak complex at Thebes during this period, and his characteristic archaic boat on its sled-like stand appears on many coffins of the period.

Other figures crowd the areas around the main depictions of the Osiris cult and its symbols. Quite striking are the seven cows and their attendant bull, most of them arranged on the two sides of the leg section. These, each labelled with its ancient name, pregnant with magic, were apparently originally intended to supply milk and meat for the dead king in the early days when an active afterlife was the exclusive privilege of royalty. Now, after 2000 years of the gradual democ-

ratization of funerary beliefs, they are thought to be available to all of the glorious dead.

Other figures on the cartonnage serve purely protective functions, such as the vulture goddess of the third register, or the knife-wielding and fearsome hippopotamus-goddesses on the shoulders. These last are present perhaps because they were believed to be particularly active in the protection of women and small children. They are, in fact, minor relatives of the goddess Taope mentioned earlier.

Thus, armed with amulets, painted about with the legendry of two mortuary faiths, and protected by benign winged goddesses and fearsome female demons, Djed.maat.es.ankh went to her tomb. Precisely where it lay we cannot now tell, but a location on the West Bank at Thebes is certain. It was almost certainly not an elaborate affair, and may have been merely a hasty pit or a corner of an older tomb being reused at the time. The fashion of gorgeous decorated tomb-chapels and carefully excavated chambers in the rock was long dead. The Egyptians of Djed.maat.es.ankh's day and social class preferred to concentrate their funerary expenses on the preparation of the mummy and the decoration of its containers, destined to be hidden forever from human gaze, rather than on a pretentious tomb that would unmistakably indicate the position of the burial to the innumerable tomb-thieves who infested the necropolis of Thebes in the 9th century BC. The best foil for such human jackals was clearly felt to be burial in an older tomb, which would have already been plundered, and might hope to be ignored in the future. Thus the rubbish that modern excavators remove from the chambers and passages of New Kingdom tombs often produces groups of burials of the later dynasties, and our Djed.maat.es.ankh may well have come from such a find.

The reason Djed.maat.es.ankh's cartonnage has never been opened is that to do so would require extensive cutting, and one would run the risk of damage to the decoration, which is its main attraction. We have nevertheless learned as much as we can reasonably expect to know about her from the texts and pictures on her cartonnage, and from the X-rays, which have been taken. Together they can be exploited to give us a fairly enlightening view of Egypt in the 9th century before Christ, a picture, I think, which is all the more interesting because it is epitomized by an individual rather than a less personal collection of artifacts. After all, what could be more personal than the person herself? ■

ROM Cartonnage 1910.10" in *A Delta Man in Yebu,* ed. A. K. Eyma and C. J. Bennet, Occasional Volume of the Egyptologists' Electronic Forum, #1, 2003). The cows proved too difficult to incorporate, and were soon abandoned. Studying the cows, and other images on Djemma's coffin, has shed light on the process by which artistic and religious ideas circulated between North and South in Egypt during this time.

Meanwhile, Stephanie Holowka has continued her interest in mummies. She has been fascinated by recent CAT-scans of Paankhenamun in Chicago. It seems that not only is his coffin very similar to Djemma's, but the unusually fine methods used in his mummification are also like hers (if you'd like to check this for yourself, go to: http://www.amico.org/AMICOlibrary/samplerecords/ex.AIC_.1910.238.html).

These similarities have raised an intriguing possibility: Were Djed.maat.es.ankh and Paankhenamun related? They were contemporaries at Thebes from the same social class. Moreover, the gentleman has the same title—iry-a'a, doorkeeper at the temple of Karnak—as Djemma's husband. Could Paankhenamun be another name for her husband, Pa.ankh.ntof?

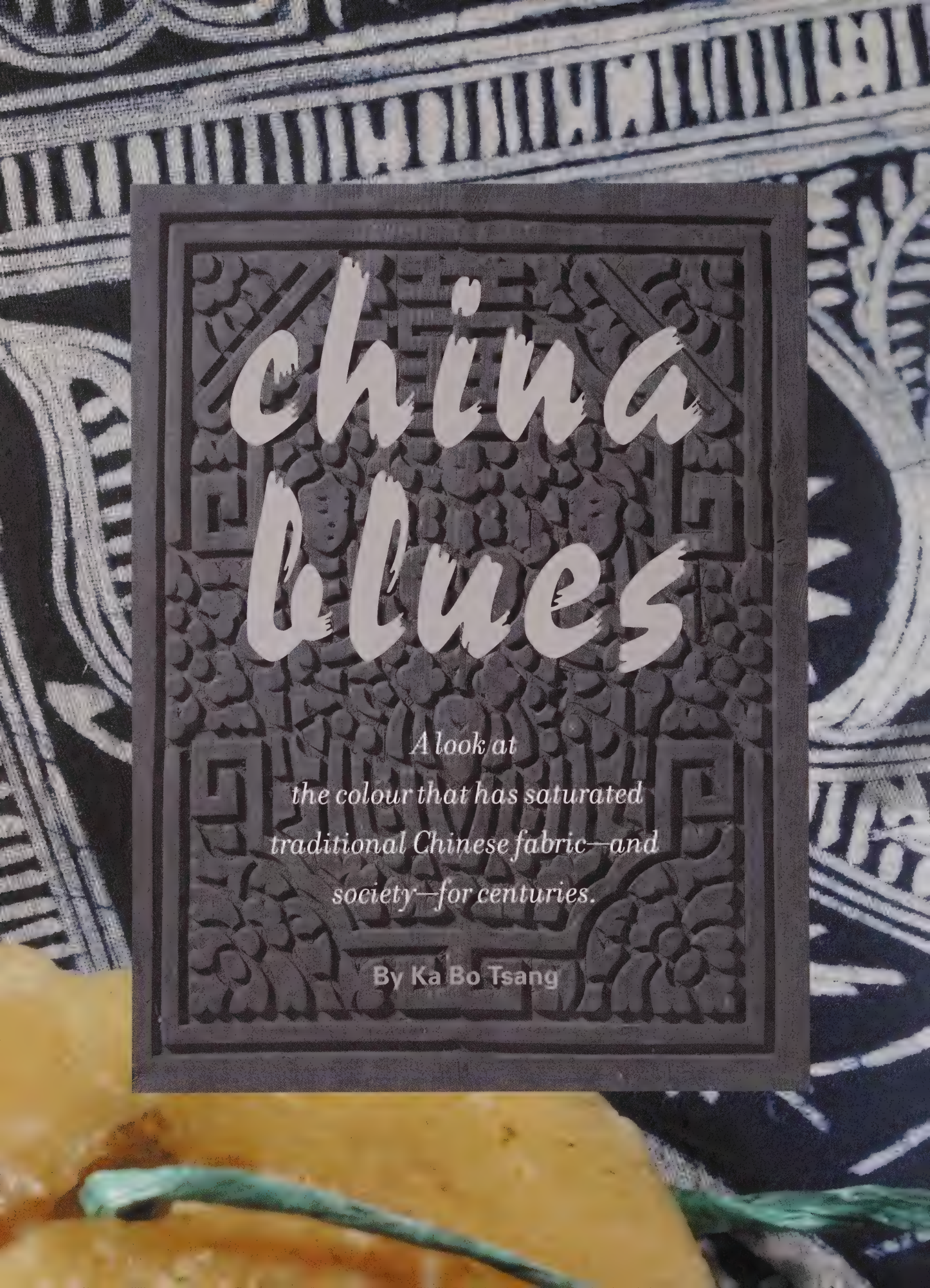
Pa.ankh.ntof, the name written on Djemma's coffin, does not occur elsewhere, and seems to have been a short form. It's rare for a husband's name to be on a wife's coffin; the name was squeezed into a small space under the tail of the black jackal on Djemma's left shoulder. Did the scribe working on Djed.maat.es.ankh's coffin, already beset by the difficulties caused by working in the latest style, shorten Paankhenamun's name to fit the little space? It's possible. It may be that further study of the coffins and mummies will provide an answer.

Studying ancient Egyptian mummies and coffins is, oddly enough, the study of life and love. As long as their names are spoken, they live. Let us hope it will be the same with Nicholas Millet, and with all of us.

—Gayle Gibson, Teacher, ROM's Programs Department.

WILLIAM M. WILLNER FUND, 1910.238. PHOTOGRAPH BY ROBERT HASHIMOTO REPRODUCTION © THE ART INSTITUTE OF CHICAGO

Top left: The name of Djed.maat.es.ankh's husband, Pa.ankh.ntof, appears on her cartonnage. This is not a usual practice. **Top right:** Mummy case of Paankhenamun. Egyptian, probably Thebes. Third Intermediate Period, Dynasty 22, c. 945–715 BC, cartonnage (gum, linen, and papyrus) gold leaf, pigment. 170.2 x 43.2 x 31.7 cm.



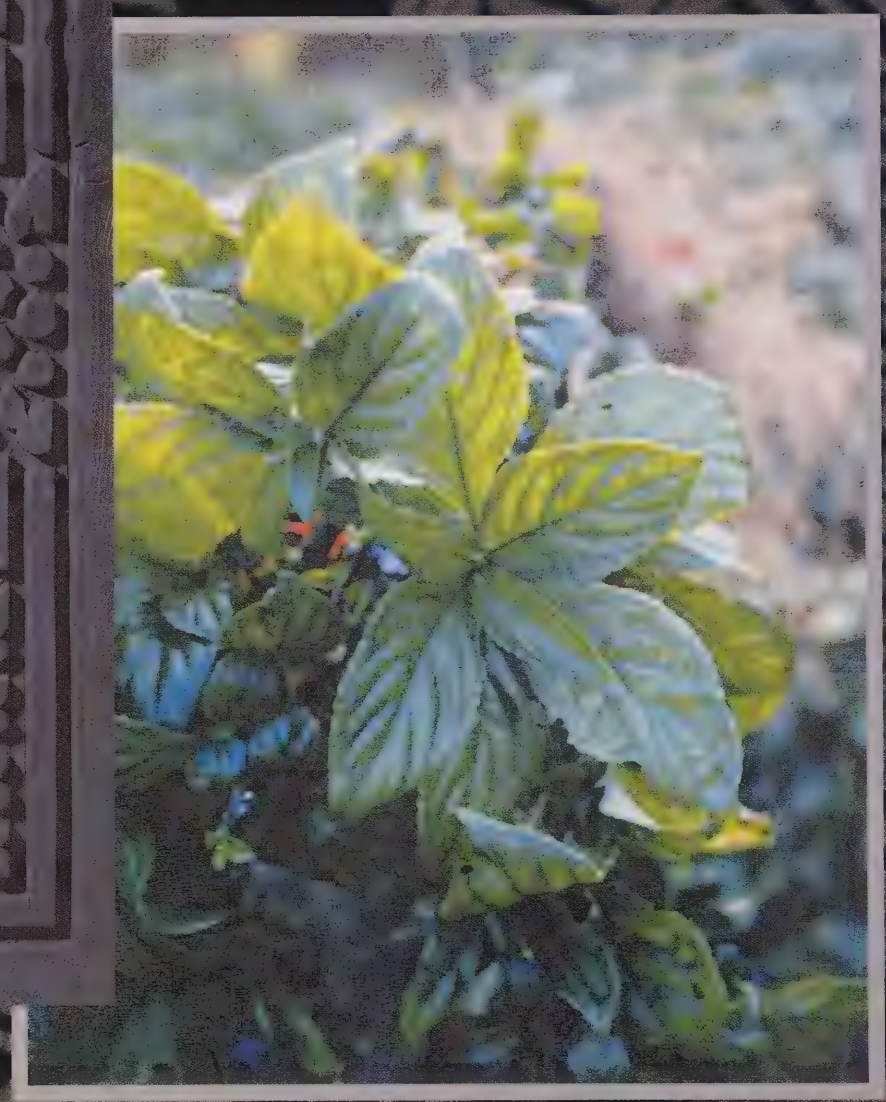
china blues

A look at the colour that has saturated traditional Chinese fabric—and society—for centuries.

By Ka Bo Tsang

In 1906, a young California couple, Bob and Grace Service, embarked with their newborn baby for Chengdu, capital of Sichuan province in western China. Bob had been charged with the mission of organizing a branch of the YMCA there. On their journey up the Yangzi River in a houseboat, the family aroused much curiosity. In Grace's memoir, *Golden Inches* (1989), she recounts how during that 21-day trip she "hung dark-blue 'coolie cloth,' the cheapest kind of native cotton material [inside the flimsy wooden partitions of their cabin], to foil any prying eyes."

Although Grace does not mention



Top: Indigo dye; with his finger, a dyer tests the purity of freshly made indigo.
Bottom: Indigo plant ready for harvesting.

whether she had the foresight to bring on-board the dark-blue cotton for that purpose, the material was common enough in China that she likely had no problem securing some from the crew for her improvised curtain. After all, this was a fabric indispensable for centuries in China, used by all walks of life for essentials such as clothing and household accessories.

In the hands of the Chinese, dark-blue cotton is a most practical and versatile fabric. They have been using it ever since the 13th century, when cotton cultivation and homespun fabric began to spread widely in southern China. Compared with bast fibres previously used by the general population, such as flax, hemp, and ramie, cotton is smooth, soft, and sturdy enough to withstand reasonable wear and tear. The dark-blue dye not only enhances durability, but also camouflages stains and dirt. Working classes, who could not afford the time to clean their clothing and household furnishings often, readily embraced this durable cloth.

The blue dye is produced from indigo, a plant cultivated in China at least as early as the Zhou dynasty (11th century – 256 BC). Simply called *lan* (blue [plant]) in those days, it is mentioned in a song in the earliest Chinese poetry anthology, the *Shijing* (or *Book of Songs*, collected during 800–600 BC), in which a distraught girl laments over her fickle lover. She murmurs her uneasiness in this verse:

All the morning I gathered blue;
But did not get a skirtful.
On the fifth day he was to come;
It is the sixth; and he is not here.
(Translated by Arthur Waley)

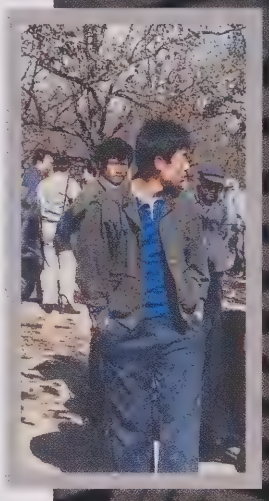
Over the centuries, the Chinese have identified a variety of plants capable of producing the blue colour. Li Shizhen, the renowned Ming dynasty pharmacologist who lived from 1518 to 1593, recorded five varieties in his *magnum opus*, the *Bencao gangmu* (*Materia Medica*, 1590). They are the *liaolan* (*Polygonum tinctorium*), *songlan* (*Isatis tinctoria*), *malan* (*Baphicacanthus cusia*), *wulan* (*Isatis indigotica*), and *mulan* (*Indigofera tinctoria*). Of these, *liaolan*, an alternative name for the ancient *lan*, has been by far the most commonly cultivated in southern China because of its easy growth and high yield of quality dye. An annual herbaceous plant, its growing period occurs between March and October. Starting from July, at least two crops of leaves can be harvested. Dye-making takes about 20 days. It involves soaking and stirring the leaves in water for a week to induce even fermentation; removing the decomposed leaves; adding suitable amounts of slaked lime (calcium hydroxide) and vegetable oil during several rounds of vigorous stirring; allowing the dye-matter to settle; straining the residue to obtain a paste; and leaving the paste to harden on its own.

Before indigo can be used to dye textiles, it must be dissolved in a warm alkaline solution—slaked lime or ashes of burnt rice stalks mixed with water—in a dye vat. The dye liquid turns yellowish green when indigo is temporarily transformed by hydrogen into what's called "indigo white." Textiles immersed in the dye first appear yellowish green. After they are lifted out of the dye vat for brief airing, however, oxygen converts the dye back to its permanent blue form again.

Several features make indigo the most versatile of all natural dyes. It can be mixed with other colourants to achieve different hues. Indigo and carthamus (red), for example, produce purple; indigo and cape jasmine (yellow) produce green. On its own, indigo can be used to dye a great variety of plant and animal fibres. Although cotton, hemp, and ramie are particularly suitable because they are unaffected by the alkaline medium of the indigo vat, silk and wool, too, can be dyed blue as long as the dye liquid has less alkalinity. Whatever the fibre used, the desired shade of blue is controlled by the number of dippings and aeration. The built-up layers of colour not only strengthen the fibres, but also give indigo its unique quality of light-fastness. Once dyed a deep blue, indigo is so colourfast that it can last for centuries, as is evident in textiles discovered in archaeological excavations. Yet, indigo is susceptible to rubbing. This setback causes indigo blue to fade after extensive washing or rubbing, though it never completely loses its hue.

Besides being a useful dyestuff, indigo is also blessed with medicinal properties. It can be used effectively to treat poisoning, bleeding, boils, insect bites, and fever. Its preventive and healing traits have led many Chinese people to believe that wearing indigo-dyed clothes is beneficial to safeguarding health.

In the 20th century, the sight of people dressed in indigo-dyed clothing was still a common one in China. Few visitors to that vast country have not been struck by how prevalent



TAMMY H. W. TSE

Top and bottom: Indigo-dyed clothing is still prevalent in China. Previous spread: Acquisiton of the woodblocks was made possible with the generous support of the Louise Hawley Stone Charitable Trust.

KA BO TSANG

KA BO TSANG

Top: Woman with a pair of engraved woodblocks that will produce a linear design by clamp-resist dyeing. Bottom left: Stencil-maker cutting a design on a paper stencil. Bottom right: Soybean paste is applied over a stencil placed on top of a fabric to transfer a design. The paste-covered areas will be reserved in white after dyeing.

its use has been. The celebrated novelist Han Suyin, for example, in the first of her five-volume autobiography, *The Cripple Tree* (1965), describes her Belgian mother's frustration and fear when she was alone in a house in a railway town around 1918, with a crying baby to pacify and an idle crowd gathered in front of her house who were "all, all in that ubiquitous, nerve-racking blue cloth, a blue of infinite variegation but still menacing as a uniform." From 1924 to 1952, a British professor, William G. Sewell, taught chemistry at two Chinese universities, one at Chengdu and the other at a nearby city called Duliang. In his two books reminiscing about his stay in China, *China Through a College Window* (1937) and *I Stayed in China* (1966), he notes not once or twice but numerous times the blue clothes the countryfolk, students, and workers wore. In *I Stayed in China* he even tells of how he and a Caucasian colleague submitted to the power of this unofficial Chinese uniform. As soon as they received invitations to join the staff of the restructured university at Duliang after the establishment of the People's Republic of China, both "felt that the time had come to don 'boiler suits' and merge ourselves with the men and women around us, who all dressed alike in their blue cotton tunics, with peaked caps on their heads." Although they felt strange for the first few days, the strangeness soon wore away. As Sewell puts it, "we melted naturally into the background of worker-friends, students, shop assistants and city workers: we all were blue ants together, working, for the most part very happily, at our various tasks."

Indigo-dyed cloth was prevalent not only in cities, towns, and villages across China, it was also used extensively in the hill country in southwestern China among the many ethnic minorities that lived there. Besides producing cloth dyed in solid blue in the standard way, these people also formulated special recipes to make the dyed products more durable and attractive. The Dong people, for example, favoured a recipe that included these ingredients: a sticky juice obtained from the rhizome of a thorny vine called the *jingang teng* (*Smilax china*), diluted animal glue, liquid strained from soybean paste, diluted egg white, and lye. They applied this assortment of sticky solutions to the indigo-dyed cotton in succession between repeated dyeing, rinsing, drying, and vigorous beating. At the end of this involved process, the treated cloth became supple and glossy, quite unlike the ordinary flat finish of indigo-dyed cloth. When an indigo-dyed fabric with a simple woven pattern went through the same process, the newly acquired sheen made the subtle surface texturing even more appealing.

While the ordinary Chinese dressed predominantly in plain blue clothes, some of them, at least from time to time if they could afford it, also wore clothing made of two-tone patterned textiles. These textiles were also used for home furnishings. Various methods created the two tones. By weaving indigo-dyed and undyed cotton yarns together, weavers could form stripes, bands, checks, or geometric configurations to appear in blue against a white background or the other way around. Resist-dyeing and embroidery provided even more effective results.

Resist-dyeing can involve tie-dye, wax-resist, clamp-resist, or paste-resist. Each relies on a medium to prevent the dye from touching the cloth where patterns are to be created. Fabrics dyed in this way show patterns either in reserve against a dyed ground (white on blue) or conversely a dyed pattern on a reserve ground (blue on white).

Tie-dyeing makes use of different ways of manipulating a fabric before it is soaked in water and then dyed. Knotting it produces amorphous and spontaneous designs after dyeing. Stitching and binding small, predetermined portions of a cloth generate more precise desired patterns or designs. During the preparation stage, cloth may be folded, pleated, crumpled, and twisted, or wrapped over a bean, a rope, or a short tube, before it has thread tied around it—all these ways enhance the visual appeal of the decorative elements. Tie-dyed designs are characterized by soft edges. Blurred images of shapes and chance colour fusion and diffusion that develop during dyeing are just some of the intriguing features of this technique.

In wax-resist patterning, specially made wax-knives are used to apply molten wax over pre-marked general design outlines on a fabric. Details are drawn in freehand. Although dye does not go into the wax-covered areas, often during the dyeing process the hardened wax develops fine cracks as the fabric is worked. Dye seeping through the cracks creates a network of fine blue lines. These highly desirable accidental markings become an integral part of the design when

MA JIANHE

KA BI TSANG

Top: Adding the correct amount of slaked lime to liquid indigo is crucial to production of dyestuff. **Bottom:** Gejia ethnic minority woman applying molten wax over sketched design on a scarf.

2004.28.64 / BRIAN BOYLE, ROM
2004.7.1 / BRIAN BOYLE, ROM
2004.68.29 / BRIAN BOYLE, ROM

Opposite page, top: Cross-stitch embroidered valance with a blue river scene enlivened with flying phoenixes and marine and land creatures floating on cresting waves. Middle: Scarf with design of a pair of cocks and fish made by wax-resist dyeing. Bottom: Paste-resist-dyed cotton adorned with striking images of double gourds and ray flowers. This page: Quilt-cover top embellished with the "hundred-boys" design, created by clamp-resist dyeing. Wearing military garb and assuming stances expressive of strength and might, the boys signify a married couple's desire for abundant male offspring who will become distinguished achievers when they grow up.

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2004.7.1 / BRIAN BOYLE, ROM

Top left: Work apron with woven checkered pattern; its ties are also woven with a great variety of Chinese characters and symbols. Top right: Miao ethnic minority sleeveless jacket made of glossy cloth, a cotton specially treated after being dyed deep blue with indigo. Bottom: Woman's jacket with attractive tie-dyed floral patterns.

the wax is removed in hot water.

Clamp-resist patterning requires a set of one or more pairs of woodblocks with engraved mirror-image designs. Each design consists of outlines cut in deep, wide grooves on the surface of a woodblock. Liquid dye flows into the design grooves from several small holes made on one long edge of the woodblock. A set of cloth-wrapped woodblocks are stacked and fastened together firmly by a metal or wooden clamp. Cloth that is sandwiched tightly between the relief lines and surfaces of the blocks does not come into contact with the dye—even though the whole apparatus is immersed in indigo. Clamp-resist patterning forms linear designs in blue and white.

Paste-resist patterning uses paste—formed by binding soybean flour and slaked lime with water—and paper stencil. A stencil is made by cutting out a design previously sketched on a piece of heavy paper. Next, the stencil is burnished, waxed, and coated with tung oil for impermeability and durability. Generally, images are fashioned with carefully planned broken lines, short curves, and dots. Placing the stencil on the fabric to transfer the design, the dyer applies paste, which sticks to the fabric wherever there are perforations. After the hardened paste is scraped off, the design appears on the dyed fabric.

Compared with the complex processes involved in resist-dyed patterning, embroidery is simple and much more flexible. Cross-stitch is the main technique, although other stitches, such as back-stitch, satin-stitch, stem-stitch, chain-stitch, and knot-stitch, are also employed for detailing. As its name implies, cross-stitch is made up of two straight stitches of equal length crossing each other in the middle at right angles. The size of each cross is determined by counting the threads of the base cloth to be worked on, usually a plain-weave fabric such as cotton and linen. Since this stitch requires neither a hoop nor a frame, it can be done anytime, anywhere. A motif takes shape by grouping uniform cross-stitches. Not only do the dense stitches make the design stand out, they also enhance the durability of the cloth. Like indigo-dyed textile patterning, cross-stitch embroidery using indigo-dyed or undyed cotton threads also creates designs in the blue-and-white palette.

While the simple colour scheme of blue-and-white textiles and embroidery may seem too subdued or sterile to North American sensibilities, the motifs decorating such products certainly are not. Flowers, birds, insects, animals, human figures are all depicted with exuberant imagination. Often they are abstracted, exaggerated, combined, or fragmented to achieve a dramatic visual effect. Aside from their rustic charm, these striking images are frequently saturated with myths and legends. Many even double as pictorial puns to evoke symbolic meanings closely associated with the basic desires of the Chinese people—notably, long life, health, good fortune, wealth, and many progeny. In addition to their decorative value, these images also serve as constant reminders of the good things in life to look forward to.

Much as they are enamoured of the blue colour, the majority of Chinese people do not live in a blue or blue-and-white scheme all the time. Typically, they will mix and match the blue with other bright colours in patterned textiles, clothing, and everyday articles. In this respect, ethnic minorities are particularly bold in exploring these possibilities to the full. On festive occasions women are bedecked with spectacular silver jewellery and colourful costumes. The dark-blue cotton—whether used as material for a jacket, vest, skirt, or simple trimming border—always provides a wonderful sombre background colour to set off brilliant hues such as the reds, oranges, yellows, pinks, and greens adorning other parts of their costume or accompanying accessories.

Indigo dye-making and textile-patterning are quite labour-intensive and time consuming. With changing times and cultural values, the young people of the 21st century are reluctant to learn traditional skills. Aniline, a chemical dye, has replaced indigo in China's now industrialized textile manufacturing. Will the country's love affair with indigo go on? It would appear that indigo dye-making and textile-dyeing will continue to decline, but may well survive in the remote towns and villages inhabited by Han Chinese and ethnic communities far removed from the influences of modern living. Will blue remain a favourite colour of the Chinese people? The answer is obvious. As long as the city-dwellers, who have long discarded the traditional blue jacket, tunic, gown, and loose-fitting trousers, continue to embrace the global trend of wearing blue denim jeans and as long as the ethnic minorities continue to cherish their heritage, blue will still rule. ■

Top and middle: Wax knives of various sizes, made of copper blades attached to slender bamboo holders. **Next to bottom:** Beeswax. **Bottom:** Recycled paraffin wax.

Caddisflies: Glimpses into

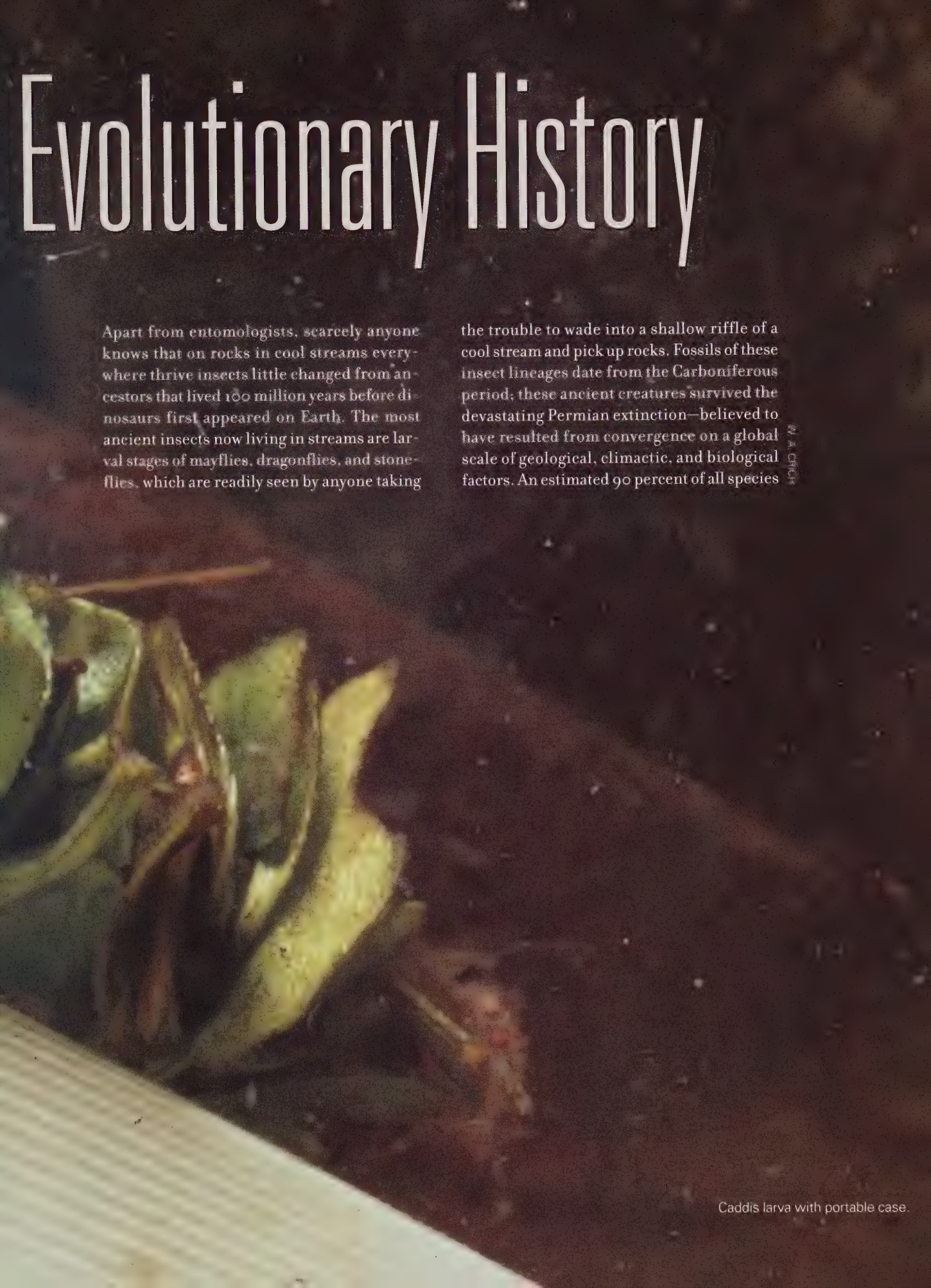
Ancient aquatic insects that are still thriving today reveal new insights into natural selection.

By Glenn B. Wiggins

Evolutionary History

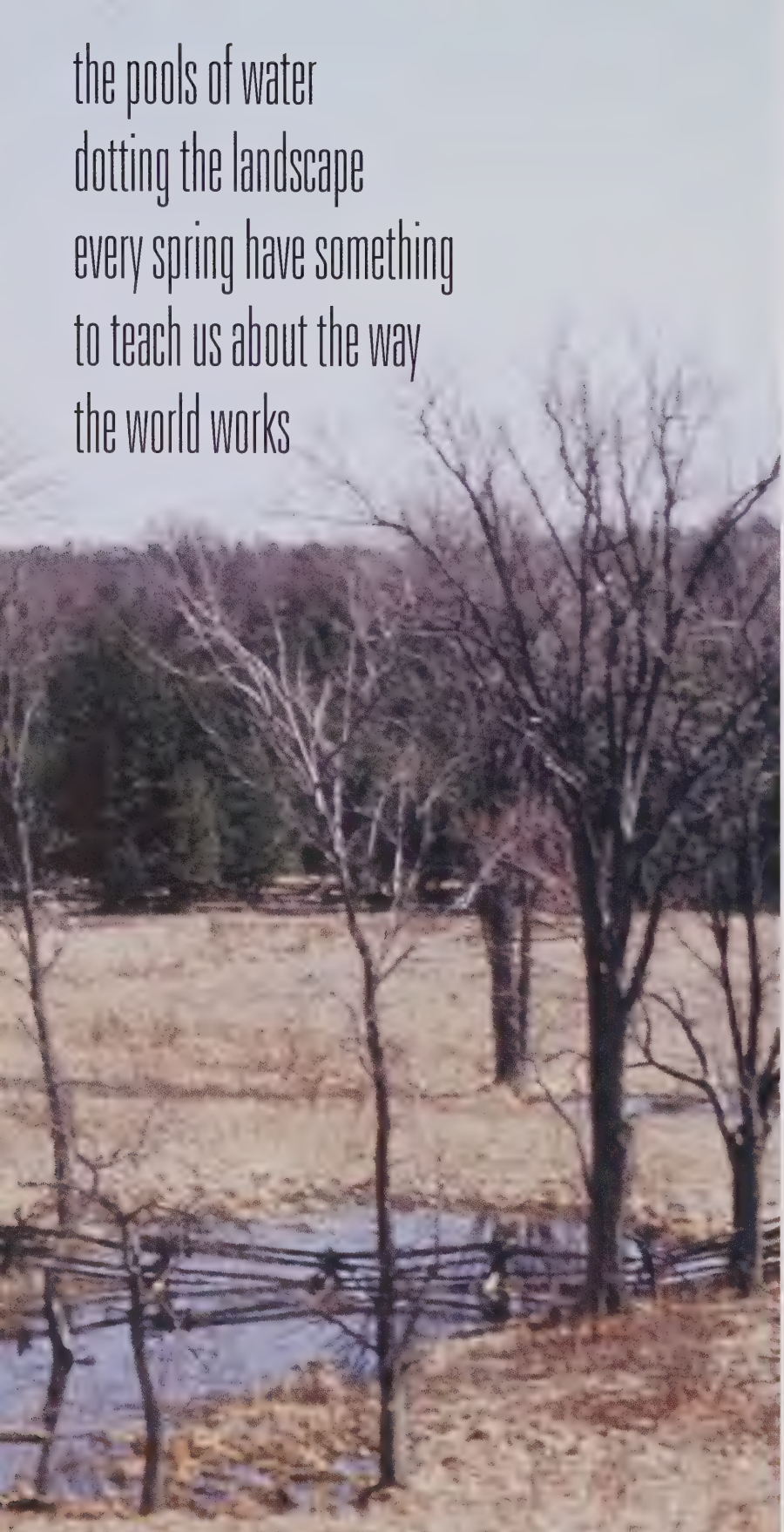
Apart from entomologists, scarcely anyone knows that on rocks in cool streams everywhere thrive insects little changed from ancestors that lived 100 million years before dinosaurs first appeared on Earth. The most ancient insects now living in streams are larval stages of mayflies, dragonflies, and stoneflies, which are readily seen by anyone taking the trouble to wade into a shallow riffle of a cool stream and pick up rocks. Fossils of these insect lineages date from the Carboniferous period; these ancient creatures survived the devastating Permian extinction—believed to have resulted from convergence on a global scale of geological, climactic, and biological factors. An estimated 90 percent of all species

W. A. CRICH



Caddis larva with portable case.

the pools of water dotting the landscape every spring have something to teach us about the way the world works



Caddisflies live in freshwater habitats of all kinds, usually in abundance, but among the unexpected places where they live are temporary pools.

E. C. WIGGINS

on Earth were eliminated, closing the Paleozoic era 250 million years ago. Also living on the same rocks in cool streams today are larvae of caddisflies, which first appear in the fossil record in Jurassic strata but probably arose during the Triassic, the first period of the Mesozoic era, where they would have been contemporaries of the early dinosaurs.

All these ancient insects have survived for such a very long time because they effectively occupy niches in the food webs of fresh waters, transmitting the sun's energy from photosynthesizing algae and plants to fish and the aquatic birds that feed on them at the top of the freshwater energy pyramid. Indeed, most running-water ecosystems would not work without aquatic insects.

When I joined the ROM staff in the 1950s as an assistant curator of entomology, my research assignment was the systematics of caddisflies, or Trichoptera, one of the ancient orders of aquatic insects. Caddisflies today number some 10,000 named species worldwide with many more yet to be identified. About 1400 species are recognized in North America, where new species are still discovered every year. My studies have not only helped to recognize some of these previously unknown species and to identify the larval stages of caddisflies but have also uncovered some intriguing insights into the unusual habitat of temporary pools and the evolution of aquatic insects adapting to survive the dry phases of these transient water bodies.

Caddisflies are unique among all insects for the array of cases and shelters constructed by their larvae. Adult caddisflies resemble small moths, but these insects are best known for the tubular cases built of rock fragments or pieces of bark or leaves fastened together with silk and carried by larvae as they forage for food. Architecture of the case is ingrained in the genetic code of the insects, and larvae in different groups construct cases of different materials and forms.

But some caddis larvae have another ecological strategy; instead of a portable case they construct a tubular shelter or retreat fixed to a rock or some other substrate where they collect food deliv-

ered by the current. Some of these retreat-making larvae spin nets of silken threads that filter food particles from the current.

My studies of caddisflies fitted into traditional museum research programs in systematics that explore and document biological diversity and provide systems of classification and identification for living things (see "How Caddisflies Fit into the Food Web and Travel the Globe," page 37).

Caddisflies live in freshwater habitats of all kinds, usually in abundance, but among the unexpected places where they live are temporary pools. These are unlikely homes for aquatic creatures because they hold surface water for only three to four months and are dry for the rest of the year. At the latitude of southern Ontario, water from melting snow collects in these basins in April. Lacking both inlet and outlet, the pools lose water through evaporation and seepage into the surrounding soil until they become dry in June or July. But looking into a temporary pool on a sunny day in May, one can see numbers of larval aquatic insects and other invertebrates, and often the most conspicuous among them are caddis larvae carrying their cases about as they forage for food.

So, for the caddisflies I studied, among the evolutionary questions were these: Why and how did the caddisflies of temporary pools become adapted to transient waters, overcoming the obstacle of a waterless period lasting up to nine months of every year? Research by European entomologists had shown that some caddisfly species undergo ovarian diapause—a period in the life cycle when egg development is suspended until reactivated by the decreasing day-length of late summer. Then the eggs resume maturation and are deposited in September or October. Although most caddisflies deposit eggs in water, there are a few groups that lay their eggs on damp substrates lacking surface water. It turned out that the caddisfly species of temporary pools are among those that have a diapause and deposit eggs on damp substrates in the absence of surface water. Provided with that information, I searched waterless basins of temporary pools in autumn

How Caddisflies Fit into the Fossil Record

Caddisflies first appear in the fossil record in Jurassic strata, but probably arose during the Triassic.

Permian extinction wave.

The most ancient insects now living in streams are larval stages of mayflies, dragonflies, and stoneflies. Fossils of these insect lineages date from the Carboniferous period. These ancient creatures survived the devastating Permian extinction.

Small caddis larvae leaving gelatinous matrix after flooding with water.

T. YAMAMOTO

months and learned to find egg-deposit sites on shaded surfaces of decaying logs lying on the pool basin, where the eggs absorbed moisture from the soil wetted by autumn rains.

These caddisflies lay their eggs in masses of a hundred or more encased in a gelatinous matrix. From egg masses collected in the field I found that larvae hatched in two weeks or so, but only when the mass was flooded with water did they crawl out of their protective globule to fashion crude cases of organic debris and begin foraging for food. Because the pool basins I was studying were without surface water until spring, the evidence pointed to the hypothesis that the tiny larvae remained in their gelatinous sanctuaries until the snowmelt of April—a remarkable interval of some seven months. This was confirmed when gelatinous masses retrieved in March from marked logs under a metre of snow were flooded with water; immediately tiny larvae vacated their overwintering shelter. The complete story for case-making caddisflies, then, is that to adapt to temporary pools, some of these species have developed ovarian diapause bridging summer drought, as well as a gelatinous egg matrix that could retain its integrity through fall and winter. The workings of natural selection are made clear by comparing the habits of caddisflies of temporary pools to the ancestral or primitive conditions retained in the majority of case-making caddisflies inhabiting permanent ponds and marshes; these species lack a diapause and deposit eggs in a matrix that liquefies shortly after the larvae hatch.

Natural selection is really about reproductive success, or put another way it is about increasing the survival rate of progeny to reproductive age. Temporary pools would provide a substantial boost to survival because fish that prey on aquatic insect larvae in permanent waters are eliminated by the dry phase.

Natural selection has been so effective in independently adapting diverse aquatic invertebrates of permanent waters in ponds and marshes for life in temporary pools that researchers can recognize some general patterns. In the 1970s, I undertook with postdoctoral associate Rosemary Mackay and graduate student

Ian Smith an intensive study of evolutionary and ecological strategies of animals in temporary pools. Like the caddisflies, some other aquatic insects can live in temporary pools because they deposit eggs after surface water has disappeared, as do the dragonflies, damselflies, mosquitoes, and midges of temporary pools. This behaviour seems to require that females must be able to predict in some way that a pool basin lacking surface water will be flooded later and retain water long enough for larvae of the next generation to complete development.

Species in other orders of aquatic insects gain access to temporary pools because they have drought-resistant eggs or larvae that lie dormant on the dry pool basin for much of the year. In these species, eggs are laid in spring before surface water has disappeared. This approach is found in some species of mayflies, beetles, midges, and certain other Diptera such as no-see-ums and soldier flies.

In the two preceding groups, tolerating the dry phase underlies their adaptation to temporary pools. These insects cope with drought. However, in a third approach, the strategy is avoidance of drought. Some species of aquatic beetles and bugs, as well as a few midges and mayflies, pass the dry phase, and winter too, in permanent ponds; and in spring adults disperse to temporary pools where a generation is completed before the pools disappear. Adults return to permanent ponds where they, or larvae of the next generation, pass the winter. Through natural selection, dispersal for colonizing outlying pools has been enhanced.

The crustaceans, molluscs, and worms of temporary pools constitute the overwintering permanent residents, which remain on the dry basin in some resistant stage. Among the crustaceans are fairy shrimp that have an ancestry of some 400 million years and retain many of the archaic morphological features of primitive crustaceans. Because fairy shrimp swim slowly through open water and are fully exposed, they would be highly vulnerable to predacious fish in permanent waters, where almost certainly they would have been eliminated long ago. So, predation by fish would have

How Caddisflies Fit into the Food Web and Travel the Globe

Systematics undertakes to reconstruct evolutionary history for, as geneticist Theodosius Dobzhansky has observed, nothing in biology makes sense except in the light of evolution. Research in systematic entomology must cope with enormous numbers of species still unrecognized in science. Consequently, study collections built up in museums through fieldwork are fundamental resources for exploring, naming, and documenting the insects of the world. Even now, however, insects constitute about 75 percent of the one million or so animal species known.

In addition to recognizing unknown species, identifying the larval stages of aquatic insects is also a significant contribution of systematics to freshwater biology. Research in aquatic ecology was impeded by this deficiency in taxonomic knowledge because insect larvae are involved in the movement of energy and nutrients through aquatic food webs. To understand how these systems work, ecologists must recognize the organisms involved.

In the 1960s, I began a research program for caddisflies aimed at identifying larvae for all of the 150 or so genera in North America. Through ROM fieldwork over much of the continent I identified larvae for nearly 400 species, which included some 40 genera for which this information was totally lacking. My book *Larvae of the North American Caddisfly Genera (Trichoptera),* published in 1977, followed by a revised second edition in 1996, opened the door to identification of the genera of larval caddisflies throughout North America, and was selected as one of the outstanding academic books of the year by the Association of College and Research Libraries in the United States. Similar studies by workers in mayflies, stoneflies, and true flies came to fruition at about the same time. With these crucial taxonomic data in hand, freshwater ecologists were able to assemble functional feeding groups: thus there are scrapers of algal and bacterial films, shredders of leaves and filamentous algae, collectors of fine organic particles, and predators on the herbivores. From this advance, feeding modes of aquatic insects could be quantified, leading to a conceptual model, the River Continuum Concept, describing how energy and nutrients are processed through the food webs of communities in fresh waters.

Taxonomic knowledge enabling biologists to identify larvae of caddisflies and other aquatic insects is also applied to environmental monitoring of water quality. Through the science of aquatic entomology, freshwater biologists can assess the biological health of surface waters from samples of the invertebrates that live there.

Studies of the geographic context underlying movements and diversification of caddisflies in different parts of the world are also an important part of reconstructing evolutionary history. Much of the early theorizing about the global distribution of Trichoptera was based on what were, not so long ago, widely accepted concepts of stationary continents and fluctuating ocean levels. Biogeography, however, has been changed profoundly by the revolution in earth sciences, revealing that continents drift over the surface of the planet. Continental movements since the Jurassic period coincide in time with the diversification of caddisflies. We now have, for example, good evidence that representatives of several southern hemisphere case-making caddisfly families were transported to the northern hemisphere when the Indian tectonic plate broke away from the fused southern continents of Gondwana some 140 million years ago to drift northward and join with the Asian plate.

These examples illustrate how museum-based research in systematic entomology contributes to understanding life on Earth.

Caddisfly adult

G. B. WIGGINS

been a powerful selective force in ancient waters for adaptation of fairy shrimp as well as other freshwater invertebrates to temporary pools where fish cannot live.

For all of these aquatic animals, it will be understood that most species can survive only in permanent waters; temporary-pool species constitute a small minority in every group.

When these examples of independent adaptation to temporary pools in many groups of aquatic insects, crustaceans, and other invertebrates are considered collectively, the conclusion is inescapable that the annual sequence of alternating wet and dry phases in discrete basins provides a crucible for evolutionary change. Genetic mutations that contribute in some way to surviving drought are tested every year in the recurring seasonal cycle. Genetic changes that work against survival during the dry phase are eliminated through natural selection; but changes that enhance survival are accrued year by year.

Long after my study of temporary pools was completed, two items from the biological literature came to my attention because they were germane to the biology of temporary waters.

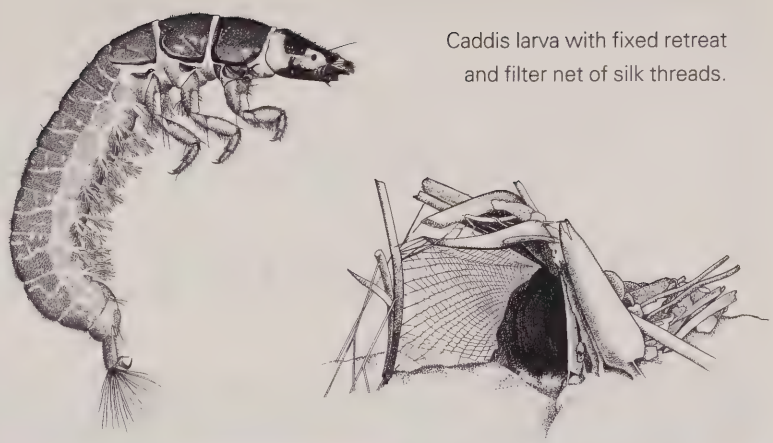
The first related to the work of paleobotanist Karl Niklas of Cornell University. In studying the early evolution of plants, he concluded that the first plants to colonize the barren landscapes of this planet arose from freshwater environments some 400 million years ago, during the Silurian period. He attributed the evolution of critical moisture-conserving adaptations such as the waxy cuticle and stomata of leaves to natural selection operating under periodic drought in habitats with fluctuating water levels. This means that the forests and grasslands blanketing continents today began from primitive colonizing plants that first became adapted to terrestrial conditions in the proving ground of transient freshwater habitats.

The second item related to evidence assembled by University of California physiologist Jeffrey Graham and coworkers. The first vertebrate animals to breathe atmospheric air were fish in fresh waters of Silurian tropical low-

lands. These researchers suggested that low levels of dissolved oxygen brought on by high temperatures during recurrent seasonal drought would have provided conditions that favoured selection for the evolution of proto-lungs to support air breathing in fish. Proto-lungs are vascularized outgrowths of the esophagus, which enabled these fish to respire oxygen from air gulped at the water surface. Lungfish surviving to the present are survivors of these ancient fish with dual systems of respiration employing both gills and proto-lungs. In modern gill-breathing bony fishes, the proto-lungs have become hydrostatic gas bladders, substantially reducing through regulated buoyancy the energy expended by fish in rising off the bottom and maintaining their preferred level in the water column. The proto-lungs of the ancient fishes also opened terrestrial living for ancestors of amphibians living in the Devonian period, which gave rise in time to the entire panoply of air-breathing vertebrates—from amphibians through reptiles, birds, and mammals, including humans.

This congruence of seminal evolutionary events in seasonally fluctuating fresh waters fully justifies description of these habitats as crucibles of evolution. Terrestrial plants and air-breathing vertebrate animals have had an enormous influence on the history of this planet. But largely unnoticed, a rich community of caddisflies and other freshwater invertebrates have gained sanctuary from predacious fish through natural selection and evolution stimulated by the same recurring wet and dry phases of temporary waters. Although unremarkable in appearance, these pools of water dotting the landscape every spring have something to teach us about the way the world works. ■

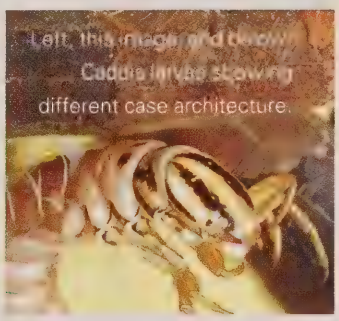
This article is derived from Dr. Wiggins's book *Caddisflies: The Underwater Architects* published in 2004 by the University of Toronto Press. Relevant information and references can be found there. The book outlines the world families of caddisflies and advances present understanding of the ecological, evolutionary, and biogeographic history of these insects.



Caddis larva with fixed retreat and filter net of silk threads.

A. ODUM

J. C. HODGES



Left, this mega- and bi-cornuate Caddis larvae showing different case architecture.

J. C. HODGES

J. C. HODGES

Fairy shrimp

T. YAMAMOTO

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First Impressions

Neither dinosaur nor jellyfish, an unusual fossil turns out to be related to everyday bathing accoutrements.

Dear ROM:

Near our house in London, Ontario, new storm drains were recently installed beside the Thames River. In and amongst the quarried stone around the drains, my son and I found several excellent fossils. One fossil in particular is really quite strange and we decided to take a few pictures of it and see if someone could tell us what it is. To me, it seems to be either some kind of fossilized jellyfish or the skin impression of something quite large. My son, 6, is already an avid paleontologist, and although he is quite convinced that this is the skin print of a giant *Triceratops*, he's very eager to have a second scientist verify his findings.

I wonder if you would help us?

S. and J. Petronis-Akins

Steve and Josha's photo of their mystery fossil.

Dear Steve and Josha,

Many thanks for your enquiry and for the excellent accompanying photos.

Your discovery is most intriguing, and, to your 6-year-old budding paleontologist, it might well conjure up images of some of those rare dinosaur-skin impressions known from the Mesozoic fossil record! It's very tempting to think of the remains of spectacular animals like *Triceratops* awaiting discovery in our own backyards, but there are, alas, *no* dinosaur fossils of any kind known from Ontario. The layered, fossiliferous rocks that overlap the very ancient Precambrian foundations of our province are, for the most part, much too old to contain dinosaurs—these strata originated as sea-floor sediments in the early Paleozoic era, long before four-legged vertebrate animals evolved to take up permanent residence on land. There is only one place in Ontario where any significant dinosaur-age deposits are found, and that's in the remote Moose River Basin, centred about 150 km (93 miles) southwest of Moosonee. Here, we see scattered exposures of river, swamp, and lake sediments that accumulated during the Cretaceous period, about 100 million years ago. These sands, clays, and ironstone lenses contain an abundance of fossilized plant remains (enough to form thick beds of low-grade coal), but have so far failed to yield confirmed remains of a single animal, dinosaur or otherwise (see also "A Charmed Find" in *Rotunda*, Volume 36, No. 2 (2003/2004).

DAVE RUDKIN

In contrast, the sedimentary rock record of southwestern Ontario, including the London area, consists mostly of limestones and shales of Middle Devonian age, formed from sediments laid down in warm shallow seas that flooded over the continent about 395 million years ago. It is among the diverse denizens of those ancient marine environments that we must seek the affinities of your peculiar specimen. With that in mind, how does your alternate suggestion—a fossilized jellyfish—play out? Ecologically and temporally, there's no problem—jellyfish would fit very comfortably into a Devonian seascape. They belong to a large and important group of anatomically sim-

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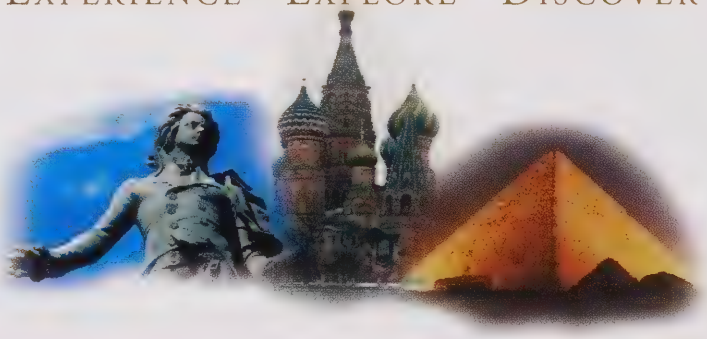

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ple aquatic organisms called the Cnidaria (which also includes corals, sea anemones, pond hydras, and a host of others) whose genealogy extends deep into the evolutionary history of the animal kingdom—the earliest fossil representatives of the group are probably tiny branching tubes from rocks dated at about 600 million years old. Unfortunately, jellyfish themselves are lousy candidates for the fossil record. Unlike their sea-bottom-dwelling stony coral cousins, they do not secrete preservable mineralized structures to support their membranous bodies—such weighty "skeletons" would be a decided disadvantage to animals that spend the better part of their lives undulating through the water column. Except under very rare and unusual circumstances, these ephemeral sacs of jelly stand virtually no chance of being preserved after death—and when they are, we almost always see evidence of their characteristic radial symmetry.

In fact, the identity of your mystery fossil lies within the array of even simpler aquatic organisms known collectively and colloquially as "sponges." Although characterized by the most basic of all animal body plans, this group (technically called the Porifera) contains a remarkable diversity of both living creatures and extinct forms. (Forget the fluorescent pink and green things on the supermarket shelf labelled as "sponges"—those are manufactured blocks of cellulose and have nothing to do with the real poriferans! But, the irregular, porous, brown blobs of traditional bathtub and bucket use are indeed the resilient, organic "skeletons" of simple marine sponges.) The genealogical history of poriferans goes even deeper than that of the cnidarians, right back to the very origin of the animal kingdom. And, because most sponges construct some sort of rigid internal framework of interlocking mineral needles or tough proteins (remember those familiar bath sponges), they also have an extensive fossil record.

In warm, shallow seas of the Devonian period, one rather unusual

Top: Rare fossil skin impression from a duck-billed dinosaur of the Cretaceous period (about 75 million years old), Alberta. The specimen is about 37 cm (14.4 inches) long. Vertebrate Paleontology Collections. **Middle:** Close-up of a rare skin impression of a duck-billed dinosaur of the Cretaceous Period (about 75 million years old), Alberta. Each individual "scale" is about 5 mm (0.2 inches) across. Vertebrate Paleontology Collections. **Bottom:** *Octomedusa*, a rare fossil jellyfish, shows eight tentacles symmetrically arranged around the central float. Of the Carboniferous period (about 310 million years old), it is from Illinois, USA. The float is about 1 cm (0.4 inches) in diameter.

ROM855 / KEVIN SEYMOUR, ROM

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subgroup of sponges called "stromatoporoids" built supporting "skeletons" (coenostea; singular: coenosteum) composed of successive layers of the mineral calcite. Secreted beneath a thin outer sheet of living cells, each calcite layer is actually an intricate meshwork of microscopic platforms and pillars. In external shape, the distinctive layered coenostea of stromatoporoids vary considerably, ranging from flat disks and narrow columns to massive domes; the outer surfaces usually feature regularly spaced swellings or knobs bearing minute radiating grooves. Stromatoporoid fossils are abundant and widely distributed in Devonian limestones in southern Ontario, where large quarrying operations expose and excavate the rocks for various purposes—including the construction of storm drains. And there, finally, is our answer: your mystery fossil is a very nice example of a Middle Devonian stromatoporoid, showing the upper surface of the coenosteum with the characteristic knobs that give it a coarse, pebbly, and deceptively reptile-skin-like texture.

I hope that's enough to keep an aspiring young paleontologist and his dad with their noses to the ground—good luck on your future fossil discoveries!

Dave Rudkin is an assistant curator of Paleobiology in the ROM's Department of Natural History.

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THE MAGAZINE OF THE ROYAL ONTARIO MUSEUM

A Poetic Piece of Pottery

The figure wearing a knitted toque in this ceramic inkstand may be a character from a poem by Robert Burns.

Dear ROM Answers,

I would greatly appreciate any information that you could supply about the ceramic object shown in the enclosed photographs. I surmise that it is a pen-and-ink stand. I inherited it from my mother and she, from her mother. To give some idea of its possible age, my maternal grandmother was born c. 1867. She bore the first of her seven children in 1887 in Baltimore, Maryland, USA. Family legend holds that somewhere in her ancestry there were shipowners, and the object was acquired by one of them. It is reputed to be a souvenir of the French Revolution (note the Phrygian cap) that was sold on the streets of Paris.

Many thanks for attending to my request.

Sincerely yours,
D. S. K., Toronto

2002.95.1366

PETER KAELLGREN

Top: D. S. K.'s inkwell. Earthenware with a mottled brown lead glaze. Probably English, c.1820–1860. Length: about 7.5 cm (2.9 inches). **Bottom:** Inkwell, mould-cast hard-paste porcelain with overglaze enamels. German, 1860s. Height: 8 cm (3.1 inches). ROM, the T. G. H. Drake Collection. Gift of the Academy of Medicine, Toronto, and the University Health Network.

Dear Reader,

Thank you for your letter. You are correct in identifying your object as an inkwell. The large hole in the forehead area gave access to the ink in the reservoir below. The smaller hole at the tip of the hat, on the right, was intended to hold the pen.

Ceramic inkwells and inkstands made from about 1770 to 1850 were often equipped with one or more holes to accommodate quill pens. Large feathers from ducks and other birds have a wide, hollow central shaft that can be cut to form a writing point. This wore down and had to be re-cut periodically, which meant that it was handy to have one or more quills in reserve. By the 1850s, steel pen nibs were becoming the norm. These fitted into a metal or wooden shaft and could be replaced as needed. Small rectangular trays then began to be used on the desk to hold pens, pencils, and writing equipment.

I agree that the knitted "toque" looks like the one worn by the French Revolutionaries and by the goddess Liberty herself. It is sometimes called a "Phrygian cap" because it was first worn by the inhabitants of the ancient Greek kingdom of Phrygia. Caps like this were commonly worn by working people and do not necessarily have any political connotations.

English ceramics have often taken their themes, forms, and decoration from royalty, public figures, literature, and the Bible. The rounded face combined with a cap represents "Souter" or "Sooter Johnny," a character in the poem *Tam O'Shanter* published in 1790 by Robert Burns (1759–1796). Burns's poem describes how Tam O'Shanter (wearing the tam which bears his name) was out drinking at the pub with "His ancient,

BRIAN BOYLE, ROM

Top: Inkwell of hard-paste porcelain with cobalt blue ground and gilding. French, Sèvres Factory, c. 1820–1830. Height: 3.8 cm (1.5 inches). ROM Collection. Given in memory of Helen Joyce by her heirs. **Middle:** Inkwell of feldspar porcelain painted with claret ground and rich gilding. English, Spode, c. 1820–1830. Width across base: 12 cm (4.7 inches). ROM Collection, gift of Mrs. Beth Parker. **Next to bottom:** Inkwell of hard-paste porcelain with blue enamel and gold decoration. French, Paris, c. 1810, marked by P. L. Dagoty, manufacturer to the Empress. Height: 7.5 cm (2.9 inches). ROM Collection. Given in memory of Helen Joyce by her heirs. **Bottom:** Inkwell of bone porcelain with overglaze enamels. English, Staffordshire, factory not identified, c. 1830–1860. Height: 8 cm (3.1 inches). ROM Collection. Gift of Mrs. Rosetta Miller.

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BRIAN BOYLE, ROM

trusty, droughty crony," Souter Johnny. During his midnight ride home through a storm, Tam is pursued by witches, who narrowly miss catching him and end up with only his horse's tail. This animated poem in the Scots dialect was very popular with the public. By the 1820s, illustrations of the poem had created popular images of Tam O'Shanter and Sooter Johnny with his c. 1790 "liberty" cap. From the mid-1830s, the Ridgway Pottery of Hanley, Staffordshire, produced fancy jugs with reliefs showing the pub scene with Sooter Johnny on one side and Tam escaping the witches on the other. Inexpensive, colourful Staffordshire pottery figures were produced of both characters. My fellow curator, Brian Musselwhite, reminded me that the Royal Ontario Museum owns a large stoneware drink dispenser modelled as Johnny's head.

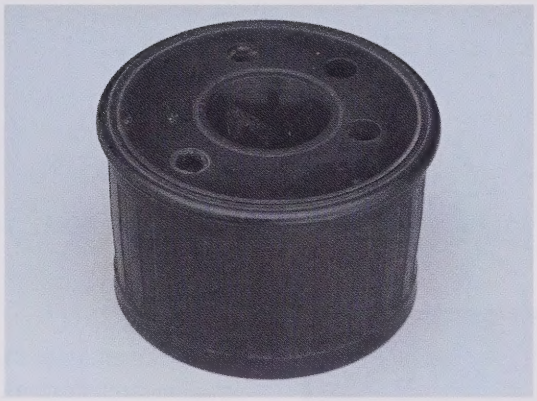
Your inkwell most likely dates between 1820 and 1860. The subject and the quality of the modelling suggest that it is likely English or Scottish. The mottled brown glaze, reminiscent of tortoiseshell, was commonly used on utilitarian earthenware objects during the 1800s. It has various names. Often it is called Rockingham because it was used at the Rockingham China Factory in Brameld, England, during the 1820s and 1830s, but other factories such as Spode used it, too. It is also known as "Bennington" because it was used by the very prolific potteries in Bennington, Vermont. Canadian potteries, most notably the one operated by W. E. Welding in Brantford (1873–1894), also used it regularly for teapots and kitchen and dairy wares.

An English Toby jug in the ROM collection shows a good-quality version of this glaze. These character jugs were named for Shakespeare's character Sir Toby Belch. Note that the jug was glazed and sold even though the left hand holding a snuff box had broken off—an indication of the quality and market for "Rockingham" wares. On your inkwell, the pale spotty coloration and crazing (i.e., cracks) in the glaze indicate less than best quality. This suggests that your inkwell may have been a "second"—potteries during the 1800s were only too willing to sell seconds in some markets—or could have been through a fire where it heated and rapidly cooled to cause the crazing.

The ROM's wide-ranging collection of ceramics is the most important one in Canada for research. It includes a number of ceramic inkwells that help to place yours in context. Wedgwood produced elegant drum-shaped inkwells with holes for quills between the 1770s and 1820s. The example shown here is made in black basalt ware, a solid black stoneware body that

was extremely popular at the time. Although the Museum lacks one of the large, fancy porcelain inkwells with beautifully painted decoration and gilding made at Derby and Worcester c. 1800–1820, the collection includes a table model made by P. L. Dagoty in Paris, who was official supplier to Empress Josephine (c. 1810). It has three holders for quills and an ink reservoir that can be removed for cleaning. The Spode firm also made some fine inkwells. The small version with a claret ground and rich decoration in gold is an example of some of the small luxury ornaments made in England during the 1820s. Also from the 1820s is the French Sèvres porcelain inkwell labelled in gold "Écritoire arbèotique," a term that I have been unable to decipher.

Ceramic inkwells were produced in a wide variety of novel forms. The ones above were made for a relatively affluent market. By the mid-1820s, examples were being produced for the regular consumer market. A good example is the bird's-nest inkwell in English bone porcelain showing a snake poised to steal eggs from the nest. The bird is trying to fend off the unwelcome intruder. The outside of the nest is covered in extruded clay chips that simulate straw and moss. A similar technique was used for the moss on Staffordshire cottages and the fur on Staffordshire sheep and poodle figures. A late example shows a young girl reading, seated on a large upholstered stool with a fringe and dressed in the fashion of about the 1860s. Although this looks like a Staffordshire figure, it is an imitation of hard-paste porcelain made in Germany. Inexpensive German versions of Staffordshire figures flooded the market in late Victorian England. They came to be called "fairings" because they were often sold or used as prizes at fairs and carnivals. Perhaps the inkwell was given to your grandmother as a child to encourage her penmanship and letter-writing. Although it cannot be documented as a souvenir of the French Revolution, it is a poignant reminder of an age long before computers when fine penmanship was a valued skill. Thank you very much for sharing your heirloom with our readers.



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BRIAN BOYLE, ROM

Top: Inkwell of black basalt ware. English, Wedgwood, Etruria, c. 1780–1820. Height: 5.2 cm (2 inches). ROM Collection. Gift of Mr. and Mrs. Egerton Brown. **Middle:** Toby jug of earthenware with a mottled brown lead glaze (Rockingham-type glaze). English, c. 1820–1850. Height: 24.3 cm (9.5 inches). ROM Collection. Gift of Thomas Phipps.. **Bottom:** "Sooter Johnny" liquor dispenser of salt-glazed stoneware. English, probably Doulton, Lambeth, c. 1830–1860. Height: 26.6 cm (10.4 inches).

Peter Kaellgren is curator of European Decorative Arts in the ROM's Department of World Cultures.

WE'D LIKE TO HEAR FROM YOU

If you own furniture, silver, glass, metalwork, ceramics, textiles, or small decorative objects that may have an interesting past and have aroused your curiosity, this column is for you. Send a clear colour photograph (or 35-mm colour slide) of the object against a simple background, providing dimensions, a description, any markings, or any known details of its history to: ROM Answers, c/o *Rotunda* magazine, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6. Be sure to enclose a stamped, self-addressed envelope large enough to include any photos that must be returned to you.

Neither *Rotunda* nor the author nor any other person who may be consulted assumes any legal responsibility for these opinions or their ramifications. No financial appraisals will be offered.

Letters will be acknowledged as staff time permits.

ROM Recycles

An old label reveals a hidden piece of ROM history.

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ROM ARCHIVES

In this era of environmental awareness, the re-use and recycling of paper in the workplace happens almost without thought, but these admirable practices apparently have a long history at the ROM.

I recently encountered a noteworthy example of frugal re-utilization of museum resources in a seldom seen part of the ROM's Paleobiology collections. There, in a drawer of specimens from a classic locality in Germany, was a small cardboard tray containing four little fossil snails of Devonian age (about 390 million years old). The specimens, probably collected at least 100 years ago, were accompanied by two small handwritten labels, one on paper and one on card stock. Innocuous in appearance, and bearing such prosaic (albeit vital) information as location, stratigraphic level, description, and scientific name, the labels seemed no different than any others of their apparent vintage. I turned over the paper label to see if there were more data on the back, and discovered that it was a piece of a page torn from an older notebook of geological observations. Cool, I thought—a nice "waste not, want not" approach to curation. Still in search of information, I turned over the card and found myself in possession of . . . a printed invitation!

By presenting this card at the door, I would be admitted to an afternoon ceremony marking the OFFICIAL OPENING of the ROYAL ONTARIO MUSEUM, at three o'clock, Thursday, March 19th, 1914.

I don't know precisely when the card was re-deployed as a label for fossils, but it was likely within just a few years of that auspicious opening. There's a good chance that the author of the annotation was none other than William Arthur Parks, founder of the ROM's fossil collections and director of the Royal Ontario Museum of Palaeontology. There are enough similarities to examples of Dr. Parks's hand that we might entertain the notion that he was the earliest known proponent of recycling at the ROM!

In March 2004 we celebrated the ROM's 90th birthday—who knows what other intimate links to our own past await discovery in our superb collections?

DAVE RUDKIN

Dave Rudkin is assistant curator of Paleobiology, in the ROM's Department of Natural History.

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